M A I N T E N A N C E M A N U A L

for powered sailplane model

A R C U S M

Edition: **O c t o b e r 2 0 1 2**

Registr.-No.:

Serial-No:

Manufacturer: Schempp-Hirth
Flugzeugbau GmbH.
73230 Kirchheim/Teck

Owner:

The translation of this manual has been done using best knowledge and judgment.
In any case of doubt the original text in German language is authoritative

0.1 Erfassung der Berichtigungen / *Record of Revisions*

Lfd.Nr. *Rev.No.*	Benennung *Reference*	Seite *Page*	Datum *Date*

MB: *Modification Bulletin* – Änderungsblatt
TN: *Technical Note* – Technische Mitteilung

Hinweis: Nicht eingefügte Berichtigungen sind zu streichen.
Das Verzeichnis der Seiten ist gegebenenfalls handschriftlich zu aktualisieren
Note: Cross out revisions which are not included.
The list of effective pages must be amended by hand if necessary.

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ÄB/*MB*: Änderungsblatt – *Modification Bulletin*
TM/*TN*: Technische Mitteilung – *Technical Note*

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Supplement:

1. Repair manual Arcus M Oct. 2012
2. Repair Instructions for Schempp-Hirth Sailplanes and Powered Sailplanes constructed from Fiber Reinforced Plastic Sept. 1991

1. Description of the components and systems

Notice:
Additional descriptions are provided in the flight manual, sections 1.4, 1.5 and 7.

1.1 Airframe

The Arcus M is a self launching two seater high performance powered sailplane made from fibre reinforced plastics, with flaps and a dampened T horizontal tailplane.

Wings:
The wing shell is a CFRP-foam-sandwich with a spar made out of carbon fibre rovings and GFRP/foam sandwich shear-web.

Fuselage:
The CFRP fuselage includes a reinforced cockpit area using aramid fibre for high impact absorption.

Horizontal tail:
The horizontal tail consists of a stabilizer and elevator.
The stabilizer is constructed from GFRP and CFRP with a foam-sandwich, the elevator has a pure CFRP shell.

Vertical tail:
The fin and the rudder are both made out of GRFP-foam-sandwich.

1.2 Control system

Elevator control system

Steel push-pull tubes lead from the control stick to an aluminium bell crank at the base of the fin, then to the steel elevator actuating bracket (also serving as the rear mount for the horizontal tailplane) at the top of the fin – see diagram 1.

Elevator deflection stops are on the control stick mounting frames.

Elevator trim

The elevator trim is situated for either seat at the seat pan mounting flanges in the left and is gradually adjustable.
Tensioning springs connect the trim to the elevator push-pull tube – see diagram 1.

Rudder control circuit

The adjustable rudder pedals are connected directly to the rudder lever by means of steel cables – see diagram 2.

Deflection stops are on the lower hinge on the fin.

1.2 Control system (continued)

Aileron control system

Steel push rods connect the control sticks via a bell crank and an interconnecting lever to the aileron differential levers, which are supported by the flap actuating levers. Short actuating rods then connect the differential levers to the funnels of the automatic hook-up system - see diagram 1.

In the inner wing panel, the steel push rods lead from the automatic control hookups in the root rib to the aileron actuating levers - see diagram 3a and 3b.

The outer most aileron on the wing tip extension is spring loaded and hooks up to the inboard aileron by a coupling overlap.

Aileron deflection stops are at the base of the control sticks.

1.2 Control system (continued)

Flap control system

Steel push rods lead from the operating handles in the cockpit via an interconnecting lever to the flap actuating levers in the fuselage centre. From there, short connecting push rods lead to the funnels for the automatic hook-up system.

The flap actuating levers also support the differential levers for the aileron, so that a symmetrical deflection of the latter is achieved on moving the flaps.

To support the force of the flap, a torsion spring is attached to the interconnecting lever.

For flaps "fully negative", a deflection stop is provided at the front end of the operating rod in the cockpit - for "fully positive", the stop is at the flap interconnecting lever mounted on the centre frame.

1.2 Control system (continued)

Airbrake control system

Steel push rods connect the operating handles in the cockpit via a bell crank and overcentering levers to the funnels of the automatic hook-up system - see diagram 1.

The deflection stop for closed airbrakes and the deflection stop for extended airbrakes are provided at the central steel frame. Additional rubber stops for extended airbrakes are provided in each airbrake box.

Inside each wing panel, steel push rods lead from the angular lever on the root rib to the two actuating arms of the Schempp-Hirth type airbrakes, see diagram 3a.

Undercarriage with wheel brake

Steel push rods connect the u/c operating handles in the cockpit (which are guided in a connecting link) to the actuating arm on the rear pivot shaft of the u/c assembly. A gas strut on the u/c assists in retracting the wheel.

For "wheel up", the travel of the u/c operating rod in the cockpit is restricted by the actuating arm resting against the steel tube centre frame; for "wheel down", the extension stop is the over centre on the rear u/c struts.
Additionally the travel of the u/c operating rod in the cockpit is restricted by the gate guiding the front operating handle.

The hydraulic wheel disc brake is actuated by steel cables (running in a bowden conduit), connecting the stick mounted brake handles to the wheel brake master cylinder.
A view of the undercarriage is provided in diagram 4.

Water ballast system(s)

For a description of the water ballast system(s) refer to section 7.9 of the Flight Manual.

1.3 Powerplant system

A description of the powerplant system is provided on pages 1.4.2 and 7.10 of the Flight Manual.

For specifications on the engine and propeller, refer to the manual(s) provided by their manufacturer.

The arrangement of the powerplant system is shown in diagram 8.

The powerplant is controlled by a multi-function powerplant operating unit, which is installed in the instrument panel. For a description of this unit, refer to section 7.3 of the Flight Manual.

Fuel system

For a description of the fuel system, refer to section 7.11 of the Flight Manual.

1.4 Electrical System

For a description of the electrical system, refer to section 7.12 of the Flight Manual.

The electrical installation of all components for the powerplant system can be seen on the wiring diagrams 9 to 15 .

1.5 Oxygen System

For a description of the oxygen system, refer to page 7.13.1 of the Flight Manual.

2. Rigging, Derigging / Rigging data

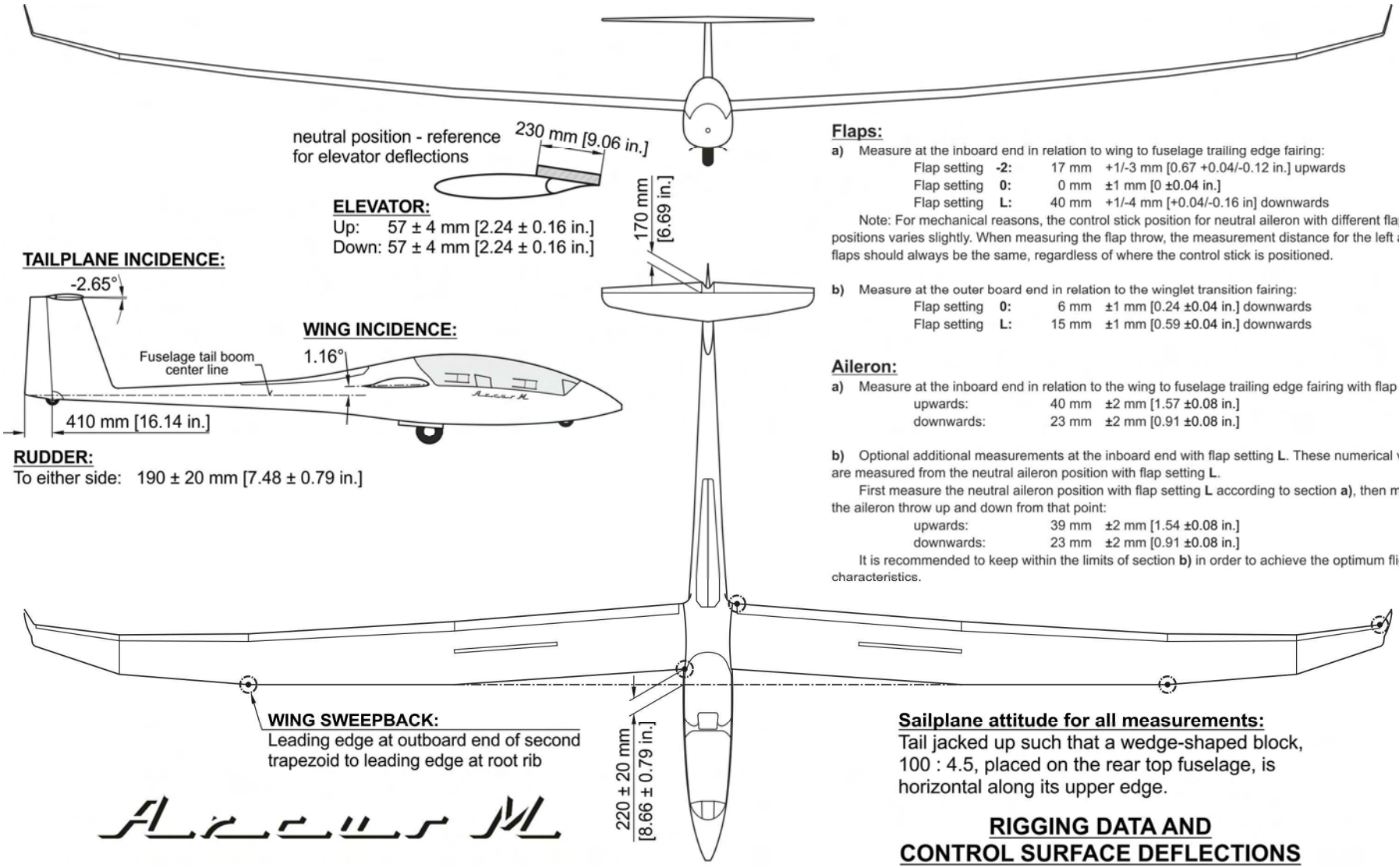
2.0 Rigging, derigging

See description in section 4.2.1 of the Flight Manual

2.1 Rigging data and control surface deflections

Rigging data and control surface deflections are shown on page 2.1.2.

After any repair it must be ensured that these data are within the permitted tolerances.


neutral position - reference for elevator deflections
230 mm [9.06 in.]
ELEVATOR:
Up: 57 ± 4 mm [2.24 ± 0.16 in.]
Down: 57 ± 4 mm [2.24 ± 0.16 in.]
170 mm [6.69 in.]
TAILPLANE INCIDENCE:
-2.65°
WING INCIDENCE:
1.16°
Fuselage tail boom center line
410 mm [16.14 in.]
RUDDER:
To either side: 190 ± 20 mm [7.48 ± 0.79 in.]
WING SWEEPBACK:
Leading edge at outboard end of second trapezoid to leading edge at root rib
220 ± 20 mm [8.66 ± 0.79 in.]

Flaps:

a) Measure at the inboard end in relation to wing to fuselage trailing edge fairing:

Flap setting	**-2:**	17 mm	+1/-3 mm [0.67 +0.04/-0.12 in.] upwards
Flap setting	**0:**	0 mm	±1 mm [0 ±0.04 in.]
Flap setting	**L:**	40 mm	+1/-4 mm [+0.04/-0.16 in] downwards

Note: For mechanical reasons, the control stick position for neutral aileron with different flap positions varies slightly. When measuring the flap throw, the measurement distance for the left and right flaps should always be the same, regardless of where the control stick is positioned.

b) Measure at the outer board end in relation to the winglet transition fairing:

Flap setting	**0:**	6 mm	±1 mm [0.24 ±0.04 in.] downwards
Flap setting	**L:**	15 mm	±1 mm [0.59 ±0.04 in.] downwards

Aileron:

a) Measure at the inboard end in relation to the wing to fuselage trailing edge fairing with flap setting **0**:

upwards:	40 mm	±2 mm [1.57 ±0.08 in.]
downwards:	23 mm	±2 mm [0.91 ±0.08 in.]

b) Optional additional measurements at the inboard end with flap setting **L**. These numerical values are measured from the neutral aileron position with flap setting **L**.

First measure the neutral aileron position with flap setting **L** according to section **a)**, then measure the aileron throw up and down from that point:

upwards:	39 mm	±2 mm [1.54 ±0.08 in.]
downwards:	23 mm	±2 mm [0.91 ±0.08 in.]

It is recommended to keep within the limits of section **b)** in order to achieve the optimum flight characteristics.

Sailplane attitude for all measurements:
Tail jacked up such that a wedge-shaped block, 100 : 4.5, placed on the rear top fuselage, is horizontal along its upper edge.

RIGGING DATA AND CONTROL SURFACE DEFLECTIONS

2.2 Weights and static moments of control surfaces

After repair work or repainting, the hinge moments of a component must not and its weight should not exceed the following values:

Component		Weight	Static moment
Rudder with Mass balance	with steerable tail wheel *	5.80 - 7.80kg 12.76 - 17.16lb	(-10.0) - (-7.00)cmkg (-0.723) - (-0.506) ftlb
	without steerable tail wheel	4.80 - 5.90kg 10.58 - 13.01 lb	
1 Elevator half without bracket		0.80 - 1.00kg 1.76 - 2.20 lb	3.65 - 4.50 cmkg 0.264 - 0.325 ftlb
Wing flaps: Inner wing inboard		2.21 - 3.07kg 4.87 - 6.73 lb	10.48 - 16.22 cmkg 0.758 - 1.173 ftlb
Inner wing centre with mass balance		2.35 - 3.05kg 5.18 - 6.73 lb	6.52 - 10.16 cmkg 0.472 - 0.735 ftlb
Inner wing outboard		0.90 - 1.29kg 1.98 - 2.84 lb	3.44 - 4.95 cmkg 0.249 - 0.358 ftlb
Wing extension		0.39 - 0.56kg 0.86 - 1.23 lb	1.02 - 1.46 cmkg 0.0738 - 0.106 ftlb

* The determination of the weight of the rudder has to be done without tailwheel and tailwheel axle. For the determination of the static moment, the rudder drive bracket has to be installed.

If the values shown in the table above are exceeded, it will be necessary to add an additional balance weight in front of the hinge axis as follows:

1. After repair in the area of the repair.

2. After complete repainting distributed along the whole length of the component (if there was no mass balance attached) or near to or next to existing mass balance.

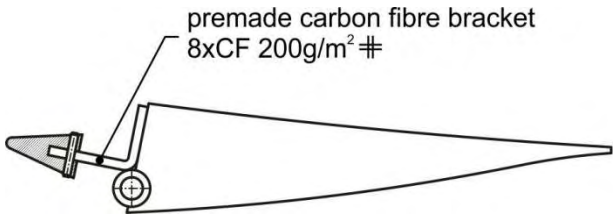
Exceeding the weight limits listed in the table above because of additional mass balance is permissible up to 15%, provided the static moment is then within the proper range.

2.2 Weights and static moments of control surfaces (continued)

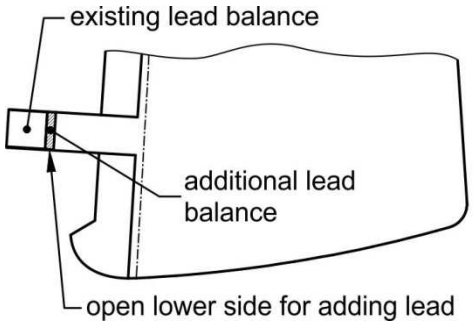
For all control surfaces the mass balance (i. e. strips of lead or steel) should be screwed or bonded with a premade carbon fibre bracket to the leading edge in front of the hinge line (max. length of a single piece: 0.5 m /19.7 in).

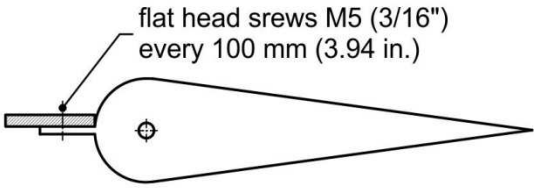
If the additional mass balance is glued to the control surface, each piece has to be secured with at least 2 locking sleeves (Ø2 x 12, DIN 1481). The distance between the locking sleeves may not be greater than 100 mm.

Middle flap of the inner wing



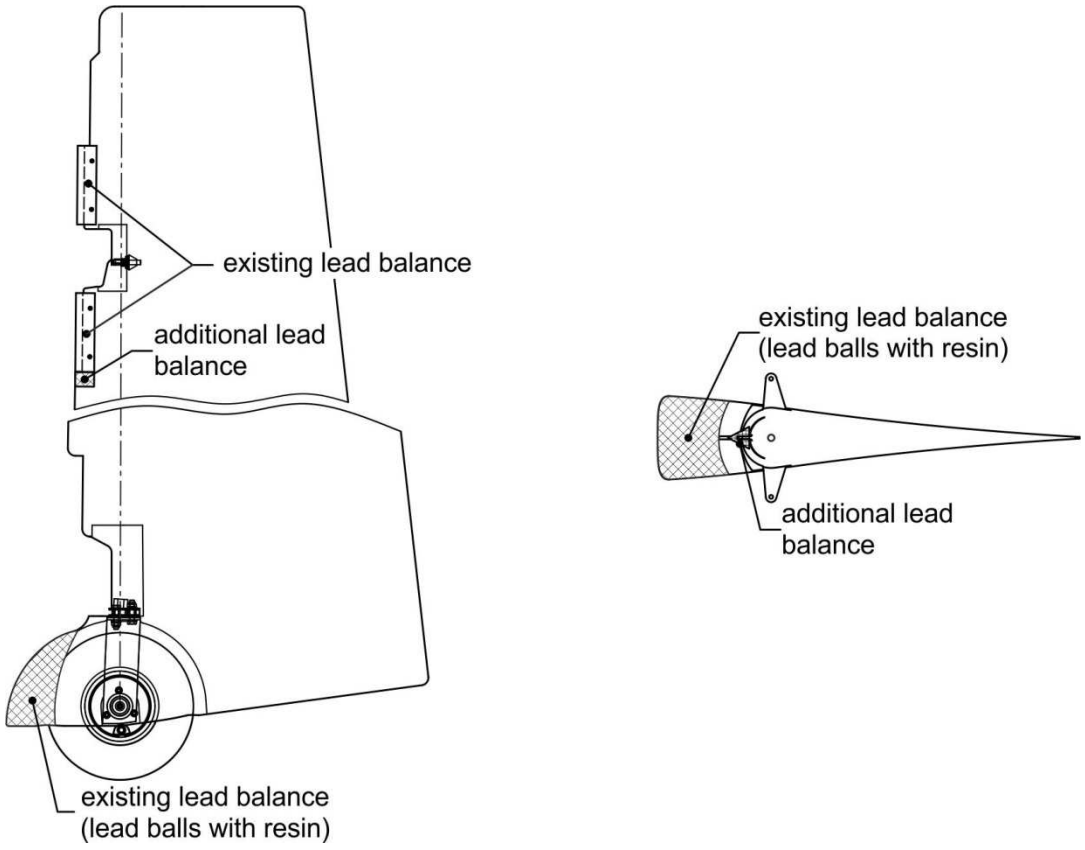
Rudder without tail wheel





2.2 Weights and hinge moments of control surfaces (continued)

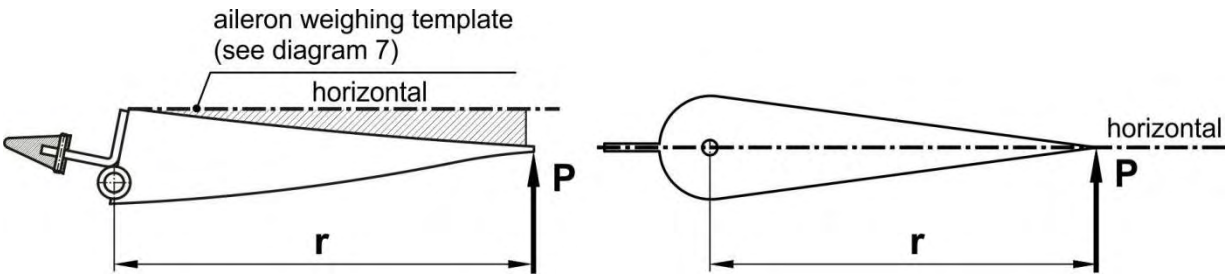
Rudder with tail wheel


existing lead balance
additional lead balance
existing lead balance (lead balls with resin)
existing lead balance (lead balls with resin)
additional lead balance

2.2 Weights and static moments of control surfaces (continued)

Determination of the static moment:

For the determination of the static moment of the different surfaces the flap / rudder have to be removed.
The flap / rudder have to be mounted frictionless in their rotational axis for the determination. The force “P” can be measured with a spring scale or a letter balance.
For the measurement the control surface has to be in its flight attitude, i.e. the airfoil chord has to be horizontal.
For the alignment of the control surfaces of the wing there are templates shown in diagram 7:



The static moment “**M**” of the flap / rudder is then obtained from the measured force “**P**” and the distance “**r**” between the measuring point and the rotational axis:

M = P x r

2.3 Play in the control circuits

With the cockpit controls fixed, the play at the control surfaces must not exceed the following values:

Inner wing:

Inner wing flap:	+/- 3 mm, (+/-0.12 in.)	measured 149 mm behind the hinge axis (5.87 in.)
Between inner and centre wing flap:	+/- 3 mm, (+/-0.12 in.)	measured 143 mm behind the hinge axis (5.63 in.)
Between centre and outer wing flap:	+/- 2 mm, (+/-0.08 in.)	measured 115 mm behind the hinge axis (4.53 in.)
Elevator:	+/- 3 mm, (+/-0.12 in.)	measured 170 mm behind the hinge axis (6.69 in.)

If there is excessive play in the hinge bearings and/or linkages, they must be replaced or the manufacturer should be contacted regarding possible measures to reduce the play.

The rudder control circuit is an open circuit, operated directly by control cables and is therefore not subject to play.

The outermost flap on the wing tip extension is pressed onto the coupling overlap to the inboard flap by a torsional spring and therefore is not subject to play.

2.4 Play in the wing attachment fittings

Tangential play (forth and aft movement) can occur through wear in the shims on the wing locating pins.

If the wing tips are free to move more than +/- 15 mm (0.59 in.) or if play of the tip extensions is observed, further shims of a thickness of between 0.3 and 0.5 mm (0.01 to 0.02 in.) with an internal diameter of

17.95 mm (0.71 in.) for the wing panels

and

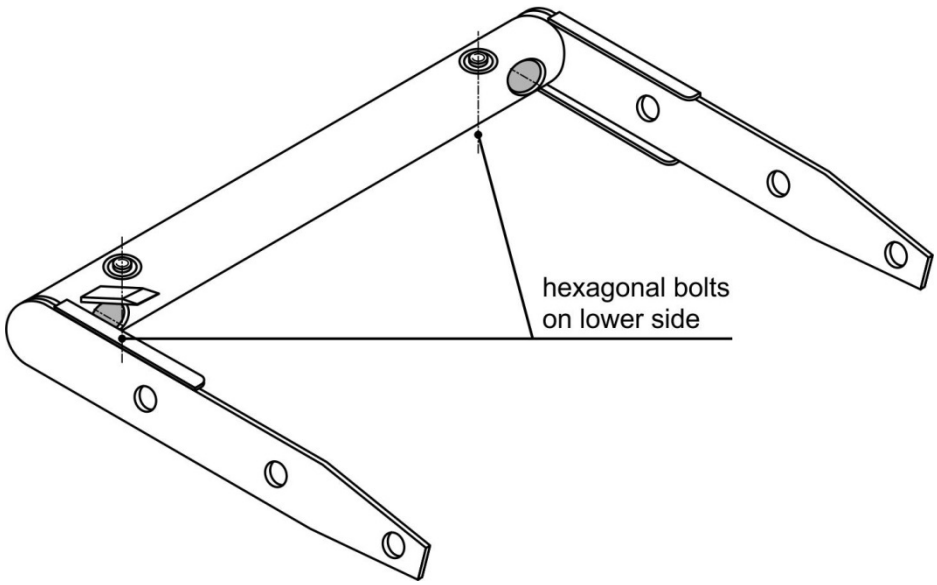
9.95 mm (0.39 in.) for the tip extensions

should be added progressively up to the point where the panels (or tip extensions) still rig easily, but the play has been eliminated.

2.5 Play in the tailplane attachment bracket

If an excessive vertical play is found at the tips of the horizontal stabilizer, then the adjustable bushings of the elevator actuating bracket should be tightened (using a 4 mm Allen key) such that the tailplane will just slide onto its locating pins.

ELEVATOR ACTUATING BRACKET



3. Inspections

NOTE:

To ensure the airworthiness of the powered sailplane the following inspections and maintenance should be conducted according to - section 3, 4 and 9 of the Maintenance Manual.

3.1 Prescribed inspections of the airframe

3.1.1 Rudder cables

Every 200 flying hours and at every annual inspection, the rudder cables are to be inspected according to FAA AC 43.13-1A § 198 at the point where they feed through the S-shaped guides to the pedals and wherever accessible. Check also position and condition of the plastic tube inside the S-shaped guides (front and rear seat)

If the cables are damaged, worn or corroded, they must be replaced. It is permissible for individual strands of the cables to be worn up to 25 %.

Making cable connections and checking them must conform to the manufacturer's instructions.

3.1 Prescribed inspections of the airframe (continued)

3.1.2 Wire ropes

When replacing wire ropes the following ropes shall be used:

	Designation	Application	Thimble	Sleeve (Nicopress)	Pressing tool (Nicopress)	Number of crimps
1	Control cable B 3.2 mm, construction 7 x 19 (1/8" MIL-W-1511 A or MIL-W-83420 D)	Rudder cable, (powerplant)-arresting wire	Hot-galvanised A3.5 DIN 6899	18-3-M or 28-3-M	51-M-850	3
					51-MJ	3
2	Control cable A 2.4 mm, construction 7 x 19 (3/32" MIL-W-1511 A or MIL-W-83420D)	Tow hook(s), back rest adjustment	Hot-galvanised A2.5 DIN 6899	18-2-G or 28-2-G	51-G-887	1
					51-C-887	2
		For use with stop sleeve	---	871-17-J	51-MJ	1
					3-MJ	1
3	Control cable A 1.6 mm, construction 7 x 7 (1/16" MIL-W-1511 A or MIL-W-83420 D)	Rudder pedal adjustment, fin water tank , propeller brake cable, throttle cable	Galvanised A2.0 DIN 65457	18-1-C or 28-1-C	51-C-887	2
					32-VC	2
		For use with stop sleeves	---	871-17-J	51-MJ	1
					3-MJ	1
4	Wire rope 1,8 mm DIN 3053 stainless	Wheel brake	Galvanised A2.0 DIN 65457	18-1-C or 28-1-C	51-C-887	2
					32-VC	2

3.1 Prescribed inspections of the airframe (continued)

3.1.2 Wire ropes (continued)

The cable connections of all control cables have to be done according to the following manual:

"Aircraft Inspection and Repair FAA AC 43.13-1A"

3.1.3 Tow release mechanism(s)

Inspections should be carried out in accordance with the "Operating & Maintenance Instructions for the TOST tow Release Mechanism(s)" - see also section 9 "Service Instructions".

3.1.4 Gas springs

In the fuselage (undercarriage, instrument panel) pull-type and push-type gas springs are installed.

The piston rods of the gas springs must always be perfectly clean and must not be damaged in any way whatsoever.

If oil escapes through the sealing for the piston rod, the gas spring must be replaced.

3.1.5 Instruments

In the case of all installed instruments and equipment, the instructions of the relevant manufacturer should be followed.

3.1.6 Safety harness

At present the service time of the webbing on the restraint systems available is limited to twelve (12) years since the date of manufacture of the harnesses.
See also the service instructions provided by the relevant manufacturer.

3.2 Annual inspection

In the course of the annual inspection the following checks are to be carried out:

Note: The required maintenance work is described by individual sections. The details for maintenance of the powerplant can be found in section 4.2.

Access to the control circuits is as follows (see also diagram 1 through 5):

- Wing control circuits

  The wing flap actuators inside the wing panels are accessible through inspection openings on the lower wing surface.
  The airbrake actuators are accessible in the airbrake box.

- Fuselage control circuits / Water ballast system(s)

  The control circuits in the fuselage including the actuating mechanism for the water ballast dump valves are accessible after removing both seat pans and the rear seat back rest.

- Elevator control

  The elevator actuating bracket is accessible with the horizontal tailplane removed.
  If required for the inspection of the bell crank at the base of the fin, an opening may be cut into the skin as shown in diagram 6a/b.

- Rudder drive

  At the rudder drive bracket.

- Spindle drive for extending and retracting the powerplant

  The spindle drive is accessible after removing the rear head rest and opening the engine bay doors.

3.2 Annual inspection (continued)

After cleaning the entire aircraft, the following checks and maintenance should be made:

- Check the aircraft externally for damage such as cracks, holes, scratches, buckling and delamination.

  If the outer layers of a component, constructed as a sandwich, have been damaged, then the inner skin must be checked as well.

  It is recommended to call upon expert assistance.

- All fittings which are mounted on GFRP / CFRP structures must be checked for tight attachment.

  Also check the CFRP / GFRP structure at the fittings for cracks, white spots and delamination.

- Check all accessible metal parts and bearings for damage.

  If repairs are necessary, request manufacturer's instructions.

- Check all accessible metal parts such as fittings, control rods (push rods) and actuating levers for corrosion.

  If necessary, remove the rust, clean thoroughly and apply a new corrosion protective coating.

  The special primer and paint for this surface protection may be obtained from Schempp-Hirth Flugzeugbau GmbH.

- Locking and mounting of the canopy

  Check the linkages for locking/opening (left side) and attaching/detaching (right side) the canopy for any damage. Check locking device of the front and rear linkage for attaching/detaching the canopy.
  Check the guides for the locking rod on the canopy frame, the locating pins on the fuselage for delamination/cracks.
  Check the front CFRP hinge for delamination/cracks and the rear hinge for deformation.

3.2 Annual inspection (continued)

- If there is suspicion or proof of leaking water tanks, the manufacturer shall be contacted.

- Check the wing water dump valves for their effective valve lift - the difference in maximum valve lift between the left and the right tank should not be more than 10 mm (0.39 in.).

- Fin ballast tank (optional)
  Check the valve and its actuating mechanism for proper function. If the dump valve leaks, it is accessible after removing the rudder, see section 5.1.
  Check that all tank spill holes are clear.

- Recommended lubrication
  The aircraft should be lubricated with acid-free grease and oil customary in trade.

  Fuselage: (see diagram 1, 4 and powerplant overview diagram 8)

  Lubricate all accessible control circuits
  (bearings with a sealed grease filling do not require any service).

  It is recommended that the guide tubes for the rudder pedal adjustment and the cables in the area of the S-shaped guides on the pedals are treated with VASELINE to ensure a smooth pedal adjustment.

  Also lubricate the linkages locking/opening the canopy and the mechanism attaching/detaching it.

  Lubricate the telescoping tube of the powerplant pylon spindle drive and the pylon bearings.

  Lubricate the attachment points of the spindle drive and the propeller pylon.

  Horizontal and vertical tailplane surfaces:
  Lubricate the accessible rudder and elevator hinges.

  Wing panels (see diagram 3):
  Lubricate all accessible connecting points in the flap/aileron actuators and airbrake control circuits and their hinges as well as the attachment points of the airbrake covers.

3.2 Annual inspection (continued)

- Undercarriage

  Check that the main wheel axle runs true, that no u/c struts are bent or damaged and that their mountings on the steel tube centre frame are not damaged. Check the wheel hub for side play.
  Check the main wheel tire pressure: 4.0 bar / 57 psi
  Check the effectiveness of wheel brake.
  Instructions on how to remove the main wheel for cleaning, lubricating and for maintenance work on the brake system are given in section 5.4.

- Tail skid (if installed)
  Check the tail skid for wear and damage.

- Fixed and steerable Tail wheel (if installed)
  Check the skin around the axle for delamination and check the tire pressure of the tail wheel (3.0 bar / 44 psi).
  If a steerable tail wheel is installed, remove the tail wheel (see page 5.1.1) to do the checks. Furthermore check the 4 mounting bolts at the lower rudder mounting for corrosion resp. damage.

- Lower Rudder bracket (if steerable tail wheel is installed)
  Remove rudder (see page 5.1.1), then check lower rudder bracket for cracks and damages, especially in the welding seams.

- Nose wheel (if installed)
  Check for delamination on the wheel housing and check the tire pressure of the nose wheel: 3.0 bar / 44 psi.

- Nose skid (if installed)
  Check for delamination in the area of the nose skid.

- Check the STATIC and PITOT pressure ports and all instrument tubes for blockage or leakage including all tube connectors.
  Check that the glass in the instruments is not loose.

- Check the equipment wiring including batteries for chafing marks and proper attachment of plugs and switches.
  Check for loose bolts and safe connections.

3.2 Annual inspection (continued)

- The harness straps should be checked regularly for any damage or stains. The metal fittings of the harnesses should be checked regularly for corrosion.

- With the aircraft rigged, check the deflections of the control surfaces with the help of an assistant (see section 2.1) and also check the control circuits and the tow release mechanism(s) for proper function (for removal and reinstallation of the tow releases refer to section 5.2).

  Check that the gap between the wing flaps is in the worst case at least 1.5 mm (0.06 in.).

  Check that the gap between the inner flap and the wing-fuselage fairing is at least 2.0 mm (0.079 in).

  Check that the gap between the inner edge of the airbrake covers and the cutout in the wing is at least 1.5 mm (0.06 in).

  Check the wing attachment fittings and control connections for excessive play (see section 2.3 through 2.5).

  Bearings with excessive radial play must be replaced.

3.3 Special inspections of the airframe

Inspection program for the extension of the service time

1. General

The results of fatigue tests subsequently carried out on wing spar sections have demonstrated that the service time of GFRP/CFRP sailplanes and powered sailplanes may be extended to 12.000 hours, if for each individual aircraft (in addition to the mandatory annual inspection and continuous maintenance) the airworthiness is demonstrated according to a special multi-step inspection program, particularly with regard to the service life.

2. Time limits

When the sailplane (or the powered sailplane) has reached a service time of maximum 6000 hours, a special inspection of the aircraft must be done in accordance with the inspection program for the extension of the permitted service time.

If the results of this inspection are satisfactory and if any defects found have been duly repaired, the service time of the sailplane (or powered sailplane) is extended by another 3000 hours to a maximum of 9000 hours (first step).

The afore-mentioned inspection program must be repeated at intervals not exceeding 1000 h service time.
If the results of these inspections are satisfactory and if any detected defects are properly repaired, the permissible service time can be gradually extend by 1000 hours to a maximum of 12000 hours.

3. The currently valid inspection program for the extension of the permitted service time must be purchased individually for each serial number and for each step of service time extension from Schempp-Hirth Flugzeugbau GmbH.
The results of the inspections have to be listed in an inspection report; every measure has to be stated.
A copy of the inspection report has to be sent to the airworthiness office at Schempp-Hirth Flugzeugbau GmbH.
Only when a written confirmation of Schempp-Hirth Flugzeugbau GmbH is present that the above mentioned inspection report was obtained, the permissible service life time may be increased.

4. The inspections may only be accomplished by a certified maintenance organisation.

4. Maintenance

4.1 Airframe maintenance

Under normal operating conditions no airframe maintenance work is required between the annual inspections, except for the routine greasing of the spigots and bearings of the wing and tailplane attachment fittings – see section 4.2 of the Flight Manual.

Should the control system become heavy to operate, then lubricate those places in the fuselage and in the wing panels where plain bearings are used (e.g. airbrake linkage, elevator trim).

Cleaning and greasing the wheel(s) and the tow release(s) depends on the accumulation of dirt.

4.2 Powerplant maintenance

4.2.1 Propeller

Maintenance work on the propeller has to be conducted according to the manual of the propeller, see section 9.

CAUTION:

For permissible operating times, mandatory regular inspections and special inspections refer to the propeller manual (see section 9).

4.2 Powerplant maintenance (continued)

4.2.2 Engine

Maintenance work on the engine is required after every 25 hours of engine operation time or at least once every year and must comply with the instructions given in the maintenance manual, see section 5, and the engine manual, see section 9.

CAUTION:

For permissible operating times, mandatory regular inspections and special inspections refer to the engine manual (see section 9).

4.2 Powerplant maintenance (continued)

4.2.3 Powerplant accessories

For maintenance work and inspections on propeller and engine refer to page 4.2.1 and 4.2.2.

a) Check of V-belt-tension

After the installation of a new V-belt set shorter inspection intervals for checking the V-Belt tension have to be observed due to increased wear during the running-in period.

Special inspection No.	Due date of inspection (Engine operating time after installation of new V-belt set)	Actions to be implemented
1	1h ± 25%	Check V-belt tension and adjust it if necessary, so that the V-belt tension is in the upper area of the normal operating range (see section 5.11)
2	5 h ± 10%	Check V-belt tension and adjust it, so that the V-belt tension is in the normal operating range (see section 5.11)

The implementation of the above mentioned inspections has to be documented together with the respective engine operating time in the aircraft logbook.
After the implementation of special inspection No. 2 the inspection interval for the following regular inspections of the V-belt can be switched to every 25 hours of engine operating time or at least once very year.

b) 25 hour / anual inspection

For all other components of the power plant (e.g. engine pylon, extension/retraction mechanism, fuel system etc.) maintenance work is to be accomplished after every 25 hours of engine operating time or at least once every year.

Check lists for accomplishing this work are found in the appendix, see P-1 and the following.

4.2 Powerplant maintenance (continued)

4.2.3 Powerplant accessories (continued)

c) Parts of powerplant system with limited operation life

Description	Replacement after first installation of part		remark
	engine operating time	calendar time	
V-belt set	50h	5 years	---
Powerplant arresting cable	50h	---	---
Fuel filter	25h	5 years	---
Wing fuel tank HFK-TLF (optional) including arresting ropes	---	10 years	---
Fuel lines made of NBR	---	5 years	---
Fuel lines made of FPM/ECO	---	5 years	---
Fuel lines made of PUR	No limitation. Replacement according condition.		---

For parts with limited operation and calendar time, the limitation that is reached first has to be considered for the replacement.

All other parts of the powerplant system, that are not listed in section 4.2.1 or 4.2.2, are to be checked and maintained according to the instructions given in section 3.

4.3 Damage

Check for any sign of change in the condition of the aircraft, such as cracks in the surface, holes, delamination in the CFRP / GFRP structure etc.

If there is any uncertainty regarding the significance of damage discovered, the aircraft should always be inspected by certifying staff.

There is no objection to minor damage – which does not affect the airworthiness in any way – being repaired on site, e.g. damage to the gelcoat, the under-carriage doors or the trailing edge of a control surface (the mass and the static moment of the latter must not increase), or scratches and small cracks in the plexiglas canopy.

Major damage to the main structure – which includes nearly all components of the aircraft – may only be repaired by a certified repair station having an appropriate authorization.

Repair instructions are found in the appendix.

When replacing the Plexiglas of the canopy, the following colors are permitted:

- clear (Plexiglas GS 245)
- green (slightly tinted, Plexiglas GS 245)
- blue (slightly tinted, Plexiglas GS 245)

For protection against fire and moisture, use the following compounds for the engine compartment:

- Pyroplast HW-100 (2 coats)

according to technical data sheets of Rütgers Organics

In addition as moisture protection:

Waterproof top coat, 4232-0303 colorless
with respective hardener

i.e. Standox PUR 2-K Gelcoat

These products have to be obtained from Schempp-Hirth Flugzeugbau GmbH.

4.4 Screw locking

If not specified otherwise at the appropriate places in the Maintenance Manual, the following methods of securing bolt connections against unintentional loosening have to be used:

a) Tightening torque for bolt connections

For all bolt connections on the powerplant that are not secured by self-locking nuts against loosening, the following tightening torques according to the Engine Manuel of manufacturer SOLO are valid (1 NM = 0.738 lbf ft):

Designation	Tightening torque	Source
Nuts and bolts M6	12 Nm	Manual for engine SOLO Typ 2625 02i
Nuts and bolts M8	20 Nm	
Nuts and bolts M10	40 Nm	

Other defines tightening torques for the powerplant:

Designation of connection (Bolt dimensions)	Tightening torque	Source
Attachment bolts for propeller (6 x M8)	20-25 Nm	„Operation and Installation Manual“ of manufacturer TECHNOFLUG / Binder
Attachment bolts for excentric propeller axle (4 x M12)	50 Nm	MM, S. 4.4.1
Attachment bolts of engine at engine pylon (4 x M8; 2 x M10)	M8: 28 Nm M10: 55 Nm	MM, S. 4.4.1
Magneto on crankshaft	80 Nm	Manual for engine MOTOR SOLO Typ 2625 02i
Belt pulley on crankshaft	100 Nm	
Coolant liquid temperature probe	20 Nm	Manufacturer information
Allen screw at rear cylinder head (M10x1)	20 Nm	MM, S. 5.14.1
Bolt connection propeller pylon to fuselage mounting	20 Nm	MM, S. 5.9.4
Attachment bolts of forward spindle drive mounting (4 x M6)	12 Nm	MM, S. 4.4.1
Nuts for the attachment of proximity switches for the propeller positioning system	8 Nm $^{+2}_{-0}$	MM, S. 5.5.6.6

The connections listed under a) are additionally secured with screw locking adhesive (see section 4.4 d).

4.4 Screw locking (continued)

b) Self locking nuts:

- At the airframe attachment devices according to the following specification are used:

  Self-locking hexagon-head nut:

  - o DIN 985-8 respectively DIN EN ISO 10511-8
  - o SSN 003

- Furthermore special attachment devices are used on specific locations at the engine. These devices are described in the respective manuals of the manufacturer of the engine.

c) Locking wire:

To secure attachment bolts, hose connections, etc. locking wire with different diameters is used:

- Fa. Goodridge, Stainless Steel Lockwire, Grade 302

Size	**Application**
0.024” (0,62 mm)	Securing of propeller attachment bolts, Bowden outer, turnbuckles
0.032” (0,81 mm)	Securing of fuel hoses
0.040” (1,01 mm)	Beringer main wheel (option): Securing of brake disc

d) Screw locking adhesives

For securing bolt connections medium strength screw locking adhesives (Loctite 243) is used. The manufacturers processing and storage guidelines have to be observed.

Locked screws have to be marked with red securing paint: Line from screw head to component.
Previous applied securing paint has to be removed before loosening the screw.

5. Instructions for assembly and maintenance work

5.1 Rudder – removal and reinstallation

Rudder with fixed tail wheel:

Remove lock nut from the lower rudder hinge and disconnect control cables.
Prior to disconnecting the control cables from the rudder horn, relieve their tension by pulling them back.
Next the plate, fairing on the right side of the balancing horn, must be removed.
Finally deflect rudder slightly to the left side and lift it free of the fin.

Preceding steps must be reversed for re-installing the rudder using new lock nuts.

Lock nut for the lower rudder hinge M8: Torque 10 Nm (7.2 lbf ft).

Rudder with steerable tail wheel: (see diagram 5)

Deflect the rudder fully to the right and to the left and disconnected the rudder cables from the drive bracket.

Then remove the tail wheel. To do so, loosen the screw connection of the axle with two Allen keys and pull out the axle. Push the tail wheel downwards and remove it.
Then unscrew the 4 M6-bolts in the wheel housing. To do so, you have to hold the other end of the M6-bolts on the upper side of the drive bracket.
Afterwards move the rudder slightly to the rear and withdraw the rudder downwards.

The reinstallation of the rudder has to be carried out in reversed order.

Mounting torque for the bolts of the rudder drive bracket:
M6: 8 Nm (5.90 lbf ft)

Fin tank water dump valve (if installed)

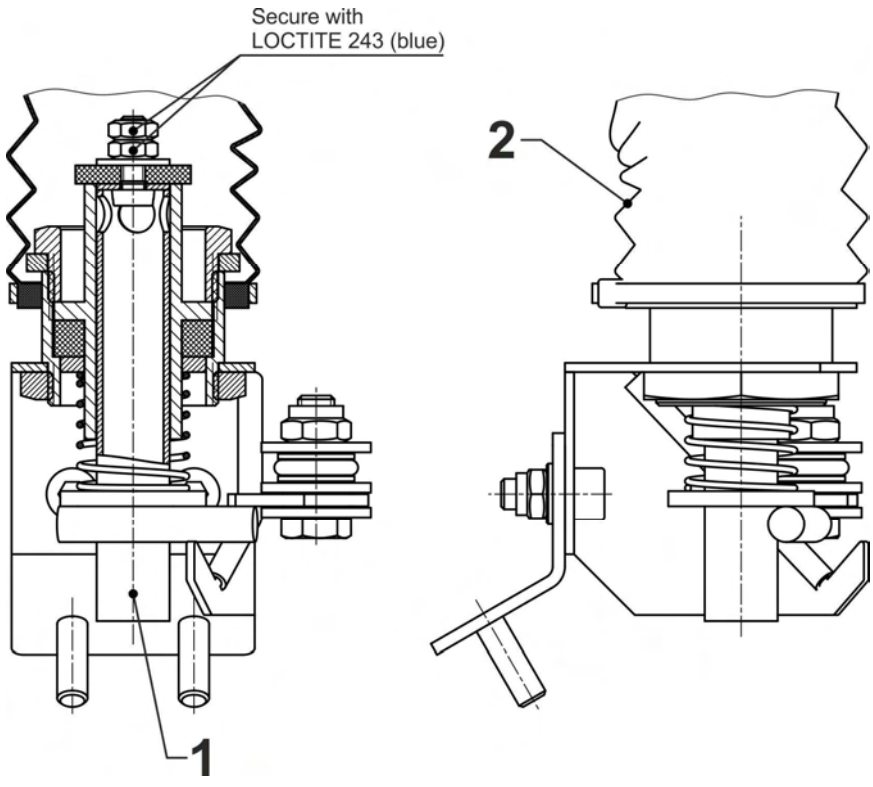
For inspection of the fin tank water dump valve the rudder has to be removed. For necessary maintenance work on the fin tank water dump valve or on its actuating mechanism refer to the sketch shown below.

The operating cable for the water ballast can be adjusted with the aid of the clamped thread end of the operating cable, which is directly connected to the operating lever below the support for the front seat pan on the right side of the cockpit. If you adjust the operating cable for the tail tank, you also have to adjust the operating cable of the wing tanks. This is done in the same way at the torsion-control rod for the water ballast of the wing, on the right side behind the seat pan of the rear pilot.
For the adjustment of the fin tank pull the rubber boot (**2**) from the dump valve and set the operating lever in the cockpit to “closed”. Adjust the operating cable so that the operating cable has no tension (max. backlash10 mm / 0.39 in).

Thereafter check the valve for proper function as follows:

With the operating lever in the cockpit at “open”, the spring-loaded valve tube (**1**) must have moved up such that its water outlet is clear.

If so, re-attach the rubber boot, close the valve and fill the tank.
Finally check the valve for leaks and proper dumping.



5.2 Tow release(s) – removal and reinstallation

Nose tow release mechanism

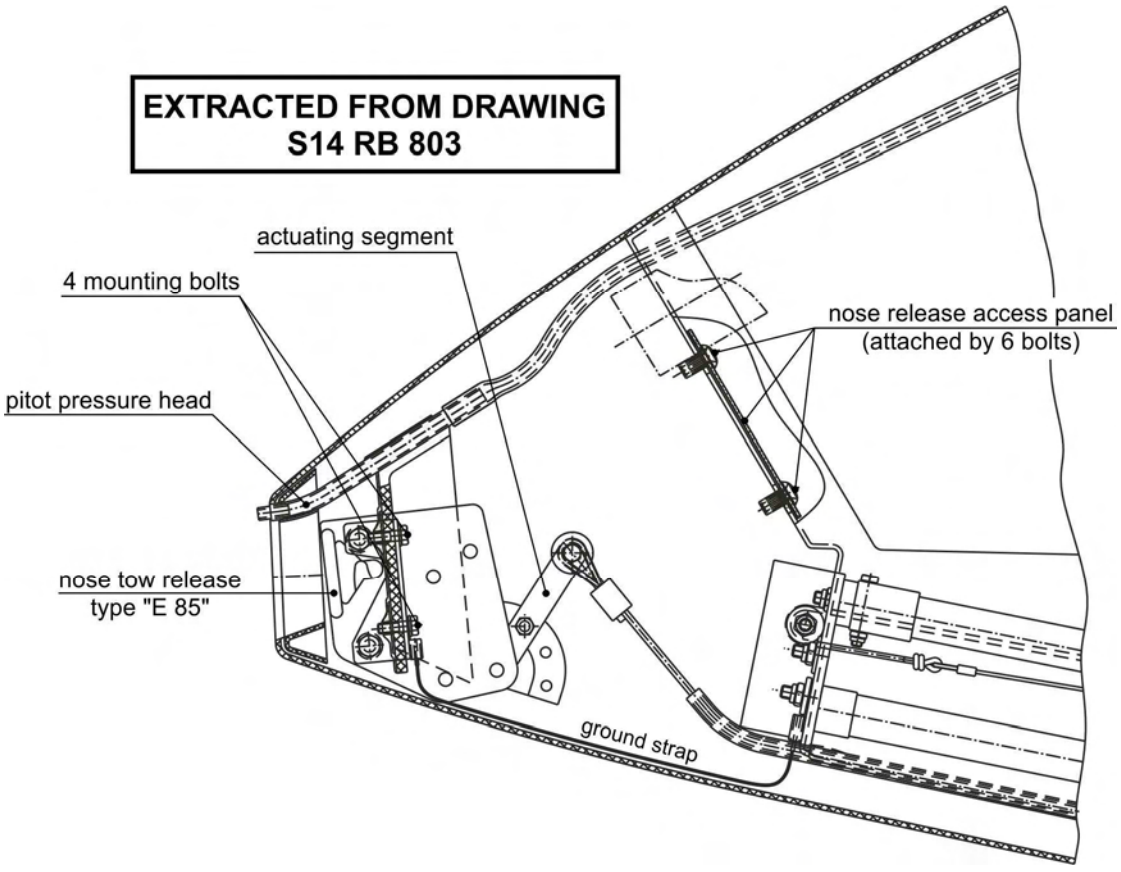
The nose tow release is located in the fuselage nose cone.
It must be checked regularly for damage and also be cleaned and greased.

To remove the nose tow release proceed as follows:

- Fold up the front instrument panel.
- Remove the nose access panel by removing its six bolts. The nose tow release is now accessible.
- Disconnect the release cable from the actuating segment (pay attention to the large washers), remove the four mounting bolts and pull the tow release clear to the rear.

Be sure that the electrical ground wire is reattached when reinstalling the nose tow release mechanism (see sketch below).

Torque: M4: 2 Nm (1.4 lbf ft)
M5: 5 Nm (3.6 lbf ft)



5.2 Tow release(s) – removal and reinstallation (continued)

C/G tow release mechanism (Option)

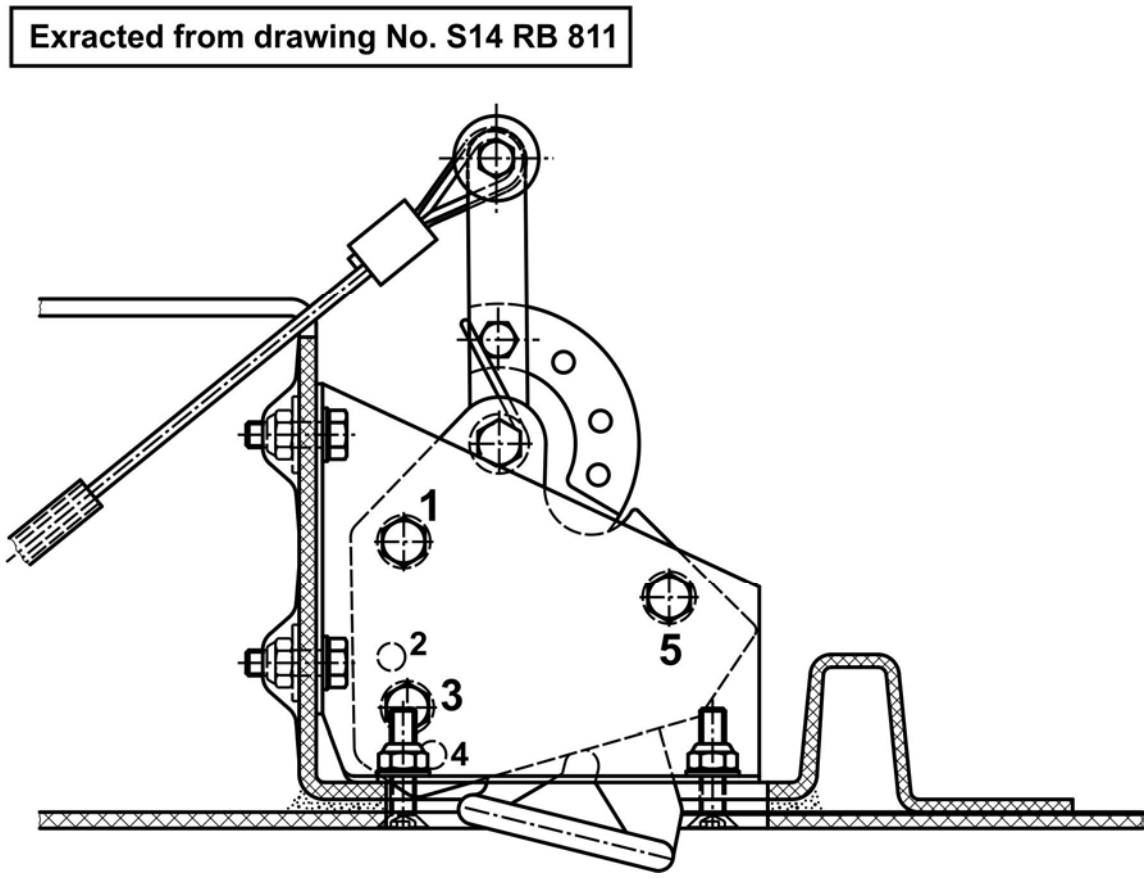
Being situated on the underside of the fuselage, the c/g tow release mechanism is vulnerable to the infiltration of dirt.

Therefore, it must be checked regularly for damage and also be cleaned and greased.

With the rear seat pan removed, the c/g tow release mechanism is easily removed by disconnecting the release cable from the actuating segment and removing the three mounting bolts (pay attention to the large washers).

Take care that the proper mounting angle is achieved when reinstalling the c/g tow release (the correct drill holes (1, 3, 5) for its mounting bolts are easily identified with the aid of the sketch below).

Torque: M6: 10 Nm (7.2 lbf ft)



5.3 Replacing the wing locating bearing bush

The main wing panels locate in four bearing bushings on the fuselage. These bearing bushings should be checked for damage (cracks) after heavy landings.

The procedure for replacing them, if necessary, is as follows:

a) Front wing connection:

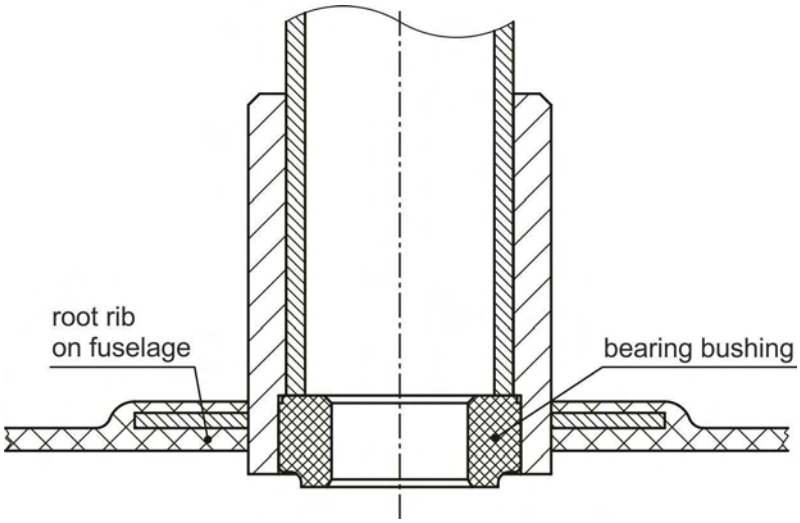
Remove bearing bushings with the aid of an extracting tool.

b) Rear wing connection:

Drive out the bearing bush from the opposite side with a steel tube (15 to 18 mm / 0,59 to 0,70 in diameter)

Install new bearing bush with Loctite (i.e. 603).

The new bearing(s) should be punched in three positions on the outer edge to lock it in place.



Rig the aircraft and check for play at the wing tip.

If the play is excessive (i.e. more than 30 mm / 1.18 in. at the tip of the wing), then follow the instructions given in section 2.4.

5.4 Main wheel with hydraulic disc brake

Removal of main wheel TOST:

When removing the main wheel to clean and grease it, first remove the two bolts attaching the brake back plate to the brake cylinder, then remove the brake calliper (hydraulic pressure hose remains attached). Disassemble the attachment bolt of the brake shield on the inner side of the swinging arm.

Next remove the cotter pin and castle nut from one side of the wheel axle and withdraw the latter. Take out the spacer on the right side of the wheel and remove the wheel,

Take care that no washers, spacers or bushings get lost. Prior to re-assembly, clean all parts and lubricate bearings, bushings and the axle.

Observe the instructions provided by the supplier of the wheel, TOST company, Munich, Germany.

Removal of main wheel BERINGER (Option):

Observe the instructions provided by the supplier of the wheel, BERINGER / company, Chătelneuf, France.

Note:
Do not disconnect the hydraulic pressure hose from the brake cylinder and do not actuate the wheel brake while the brake caliper is removed from the brake disc.

The hydraulic wheel brake may be actuated by the handles provided at the control sticks, see diagram 4.

Wheel-brake handle in the front seat:

The Bowden cable is directly connected with the actuating segment of the brake master cylinder.

Wheel-brake handle in the rear seat:

The Bowden cable is connected to the front attachment face of the brake master cylinder. The outer tube of the Bowden cable fits against the actuating segment of the brake master cylinder and moves the actuating segment forward when the rear wheel brake is applied.

When reduced effectiveness of the wheel brake is observed, see page 5.4.2.

5.4 Main wheel with hydraulic disc brake (continued)

In case of reduced effectiveness of the wheel brake

1. Check brake pads:

   If the thickness of the brake pads is less then 1.5 to 2mm, replace brake pads. In this case both parts of the brake calliper have to be removed.

2. Check that there are no leaks in the hydraulic-system.

3. Check brake fluid:

   a) Remove the front seat pan.

   b) Remove the cover of brake fluid-container.

   c) If necessary refill the missing brake fluid and bleed the braking system as described on page 5.4.3.

   d) Check the effectiveness of the wheel brake. Afterwards reassemble the parts.

4. Readjustment of the Bowden cables:

   a) The Bowden cables may be readjusted at the adjustment point at each control stick only until the gap between the actuating segment on the brake master cylinder and the cylinder case is no more than 1.0 mm (0.04 in) when the wheel brake is relieved.

      To check the readjustment pull the brake handle several times. With relieved wheel brake:
      i) the wheel can still be rotated by hand
      ii) it should to be possible to push the brake caliper in towards the wheel by hand

   b) Check the function of the wheel brake again after installing the seat pan.

Note:

Normally the brake system must be bled if the fuselage has been stored inverted! If the brake handle is fixed in the pulled position during the inverted storage of the fuselage, the bleeding of the brake system is usually not necessary.

5.4 Main wheel with hydraulic disc brake (continued)

Bleeding the brake system

1. Pressure bleeding via separate wheel cylinder bleeder valve

   a) Connect a hose (having a suitable fitting) of a pressurized hydraulic fluid service unit to the wheel cylinder bleeder screw and open the valve of the service unit.
   b) Remove the filler cap from hydraulic fluid reservoir.
   c) Open the bleeder screw slightly (approx. ½ turn).
   d) Feed fluid into the brake system until the reservoir is full. Check the fluid is clear of air bubbles. If necessary, remove fluid by suction and continue filling.
   e) Tighten the bleeder screw on the wheel cylinder and close the valve of the service unit.
   f) Install the filler cap onto the hydraulic fluid reservoir.
   g) Disconnect the hose of the service unit from the wheel cylinder bleeder screw.
   h) Check the wheel brake effectiveness.

2. Bleeding (without hydraulic pressure pot)

   a) Connect a transparent hose to the wheel cylinder bleeder screw at the brake caliper – immerse its open end in a hydraulic fluid container.
   b) Remove the filler cap from the hydraulic fluid reservoir and fill it (see marking).
   c) Build up pressure by moving the actuating segment on the brake master cylinder repeatedly, then open the wheel cylinder bleeder screw until brake fluid escapes.
   d) Continue pumping (move actuating segment such that it contacts the cylinder case) until escaping fluid is clear of air bubbles.
   e) Tighten the wheel cylinder bleeder screw.
   f) If necessary, fill in more brake fluid, then reinstall the filler cap of the hydraulic fluid reservoir.
   g) Check the wheel brake effectiveness.

CAUTION: Use only approved brake fluids complying with SAE-SPECIFICATION J 1703 or US-SPECIFICATION FMVVS 116, DOT 3 through DOT 5, based on glycol.

CAUTION: DO N O T SPILL ANY BRAKE FLUID!

5.5 Maintenance of manual and automatic propeller brake

5.5.1 Description

The propeller is decelerated and hold in proper retracting position by a mechanical propeller brake. The position of the propeller is detected by contact-free proximity switches. These proximity switches are located at the upper pulley of the belt transmission.
The brake lever of the propeller brake is mounted at the lower end of the propeller pylon and is operated by Bowden cables. The brake lever is equipped with a brake pad which acts on a brake drum. The restoring force for releasing the brake is generated by a compression spring located on the brake lever.
The brake drum is mounted on the crankshaft of the engine in front of the lower pulley of the belt transmission.

The brake lever can be actuated by two independent systems. For this reason, two Bowden cables engage the brake lever:

- Bowden cable to the brake handle of the manual propeller brake in both cockpits. The Bowden cable is attached to the brake lever at the outer station, combined with the brake lever return spring.

- Bowden cable to the electro-magnetic servo in the engine compartment (automatic propeller brake). The Bowden cable is attached to the brake lever at the inner station.

Note:

Adjusting the Bowden cable of the propeller brake can be done with partly retracted powerplant. On the basis of experience gained so far the position of the powerplant has no influence on the function of the propeller brake.
Nevertheless a functional test with fully extended powerplant should be made before operating the powerplant.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.2 Basic setting of propeller brake lever

After replacement / modification of the guiding slot for the brake lever, the mounting of the brake lever, the brake drum or other essential components the basic setting of the propeller brake lever has to be verified according to the following procedure:

a) If possible install new brake pad to the brake lever and wear it in (see section 5.5.8 c))

b) The limit stop for the released position of the propeller brake lever is at the upper end of the guiding slot. If the brake lever is pressed manually to the upper limit stop at the guiding slot (position brake released), the clearance between the brake pad and the brake drum has to be within the following tolerances (see sketch on following page):

No.	Condition brake pad	Allowable clearance “a”
1	New installed brake pad	0.5 mm +0.5 mm -0 mm
		0.020 in +0.020 in - 0 in
2	Normal operating range (Used brake pad, but wear limit of brake pad not yet reached)	0.5 mm to 1.5 mm (0.020 in to 0,059 in)

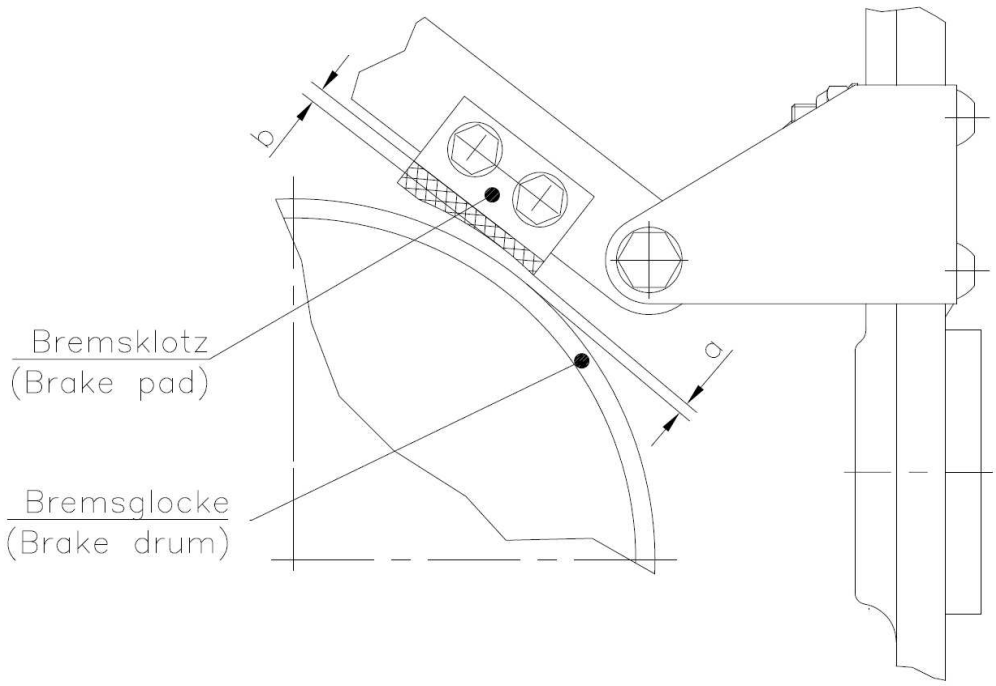
If the clearance “a” is beyond the specified range, the Bowden cable has to be readjusted resp. the brake pad has to be replaced. If the guiding slot shows signs of wear which might hinder the reset of the brake lever the guiding slot has to be replaced.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.2 Basic setting of propeller brake lever (continued)

c) The brake pad has to be replaced, when it reaches its wear limit:

No.	Condition of the brake pad	minimum thickness of brake pad “b”
3	Wear limit of brake pad reached	1.0mm (0.0394 in)



5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.3 Adjustment of manual propeller brake

a) Establish initial position of the brake lever according to section 5.5.2 (Position brake open). If the manual propeller brake is not actuated, the handles of the manual propeller brake in the cockpit are not allowed to touch the Bowden outer, but at room temperature the clearance has to be at least 2 mm to 3 mm (0,079 in to 0.118 in). The adjustment of the clearance can be done with:

   i) the adjustment screw on the Bowden outer at the propeller pylon directly in front of the brake lever (preferred measure).

   ii) the clamping connection for the brake cable at the brake lever.

b) After the handle for the manual propeller brake in the cockpit has been pulled and released again, the compression spring has to be able to push the brake lever back into its initial position (Position brake released and free of brake drum).
   Otherwise check the Bowden cable of the manual propeller brake for damages or other reasons for increased friction. Check also the condition of the compression spring. Any defects have to be corrected before next flight with powerplant operation.

Note:

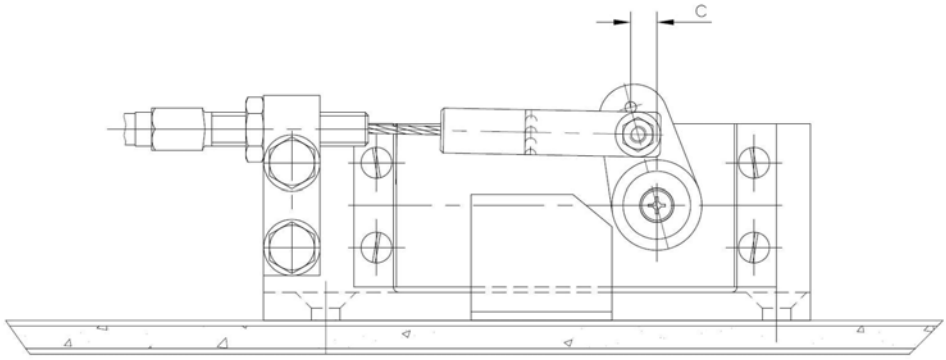
Make sure that the brake lever of the manual propeller brake is at the front limit stop (Position brake released) before starting the adjustment. The brake lever on the brake servo can be moved by hand for this.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.4 Adjustment of brake servo for automatic propeller brake

a) After adjusting/checking the manual propeller brake according to section 5.5.3 establish again the initial position of the brake lever according to section 5.5.2 (Position brake released).

b) Position the drive lever of the brake servo in the engine compartment according to sketch below:
Nominal dimension "c" = 5 mm ± 1mm (0.197 in ± (0.0394 in)
Adjust the length of the Bowden cable at room temperature so that the clevis can be mounted on the drive lever of the brake servo and the brake lever is still in the completely released position according to section 5.5.2



The adjustment of the appropriate length of the Bowden cable for the brake servo is possible by

i) Adjustable clevis (if adjustable clevis is installed, preferred measure).
ii) Adjusting screw for the Bowden outer at the propeller pylon resp. at the mounting of the brake servo.
iii) Moving of clamp connection of Bowden cable at the brake lever.

c) Check limit stop for the drive lever on engine compartment wall for tight fit.

Caution:

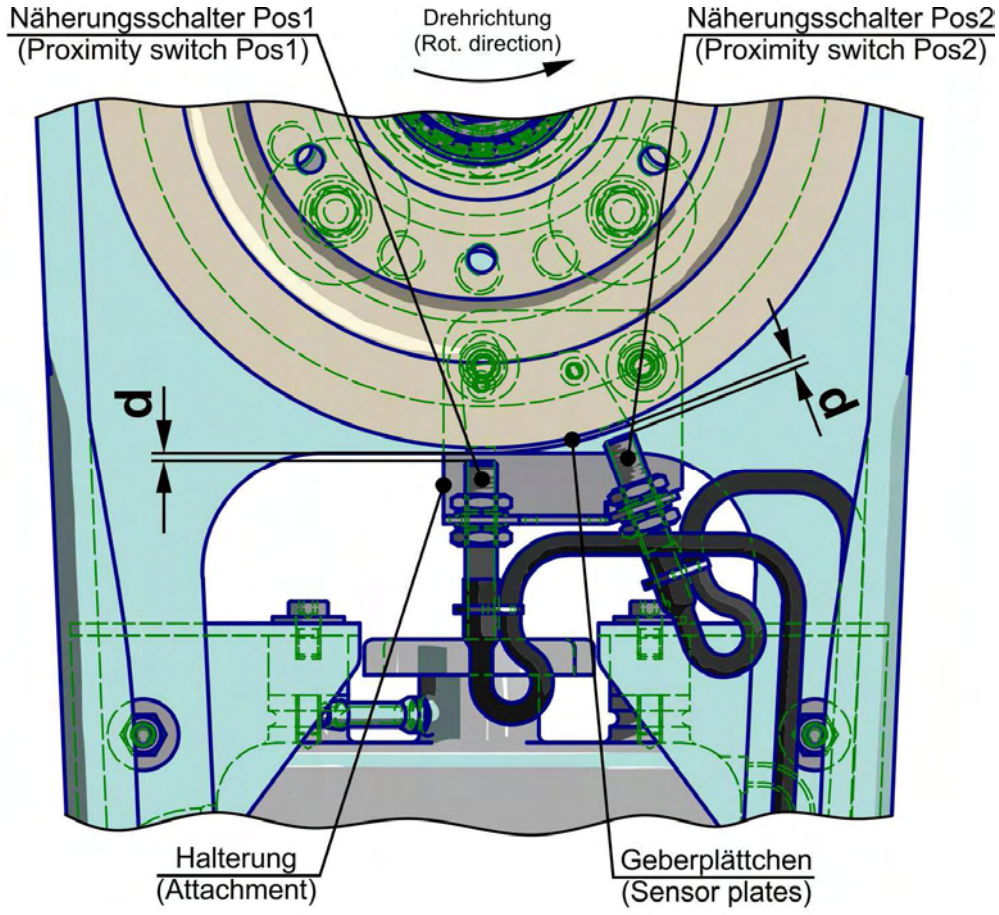
Repeated loosening and tightening of the clamp connection for the Bowden cables will damage the inner wire of the Bowden cable. If the adjustment of the clamp connection is necessary the condition of the inner wire has to be checked carefully. If in doubt, replace the Bowden cable!

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.5 Basic setting of proximity switches for automatic propeller brake

a) Determination of propeller position:

The area of the propeller position for the automatic retraction of the powerplant is defined by two proximity switches.
Both proximity switches are located on a combined attachment directly below the upper belt pulley. Together with two sensor plates, which are located at opposing positions on the upper belt pulley, they are used to determine the position of the propeller during the automatic propeller positioning process.



View opposite to direction of flight (without propeller). Shown is the arrangement with propeller in retracting position.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.5 Basic setting of proximity switches for automatic propeller brake (continued)

b) Reasons for checking the proximity switches

The function and the adjustment of the proximity switches must be checked and corrected if necessary if:

- error messages on the powerplant operating unit point to a malfunction of the proximity switches (see FM section 7.3).
- centering the propeller in the retracting position no longer works reliable.
- the tension of the V-belt set was readjusted (-> Position of upper belt pulley to proximity switches has changed).
- one or both proximity switches or the attachment for the proximity switches have been replaced.
- one or both sensor plates (pick up) at the upper belt pulley have been altered by replacement / repair.
- other activities or events occurred that could affect the system for the determination of the propeller position.

Note:

For the functional test of the proximity switches the Master switch and the circuit breaker for the powerplant control system have to be turned on.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.5 Basic setting of proximity switches for automatic propeller brake (continued)

c) Functional test of proximity switches

The proximity switches are equipped with an LED at the bottom of their housing where the connection cable emerges from the housing. Both proximity switches are connected so that this LED is off when an electrically conductive object approaches the upper end of the proximity switch.
The proximity switch is functional when the LED reacts to the approach of the sensor plate or any other electrically conductive object.

Note:

Due to their light intensity by daylight the LED is difficult to detect. Under such conditions it is necessary to dim out the LED with i.e. your hand, to be able to observe the switching of the LED.

d) Basis setting of distance of proximity switches

To adjust the distance of the proximity switches, the propeller has to be turned into the retracting position (center position) by hand. The two proximity switches must then be directly opposite to the sensor plates. If this requirement is not met with centered propeller, both proximity switches have to be moved in their holes resp. the mounting plate of the proximity switches has to be moved. The objective is that the central axes of the proximity switches and sensor plates coincide.
If the lateral alignment is done, the distance of the proximity switches can be set:
Nominal dimension d = 2mm ± 0.2mm (0,079 in ± 0.008 in)
(see sketch page 5.5.5.1).
Thereafter don't tighten the screw connection of the proximity switches to their mounting plate yet, because they might have to be loosened again during the further adjustment process.

Caution:

The correct distance between the proximity switches and the sensor plate has to be checked in both retracting positions of the propeller. In case of asymmetry the sensor plates have to be checked for damages and carefully corrected.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.6 Adjusting the operating range of proximity switches for the automatic propeller brake

a) Test Mode

The powerplant control system facilitates the adjustment of the proximity switches when it is switched for this purpose into the “Test Mode”.
Only in this “Test Mode” the automatic retraction process of the propeller pylon will be continued when the propeller is moved back into its retracting area manually after this position was lost before. The “Test Mode” will only be left when the powerplant control system is switched off and on again.

Switching into the “Test Mode”:

i) Ignition OFF and extract the powerplant completely with manual operating switch.

ii) Turn the propeller manually against the direction of rotation out of the retracting position.

iii) Press and hold the MENU-button for 5 s.

To cancel the “Test Mode” the powerplant control system must be switched off and on again.

b) Adjusting the operating range of the proximity switches – *forward limit* of the retracting area

i) Ignition OFF and extract the powerplant completely with manual operating switch.

ii) Turn the propeller manually against the direction of rotation out of the retracting position.

iii) Switch Ignition ON and OFF again.

iv) Confirm the “BRAKE?”-message on the operating unit with the MENU-button.

v) Turn the propeller slowly by hand into the retracting position.

vi) First position detection occurs when the sensor plate arrives at the proximity switch “Pos1”. Then the brake servo engages.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.6 Adjusting the operating range of proximity switches for the automatic propeller brake (continued)

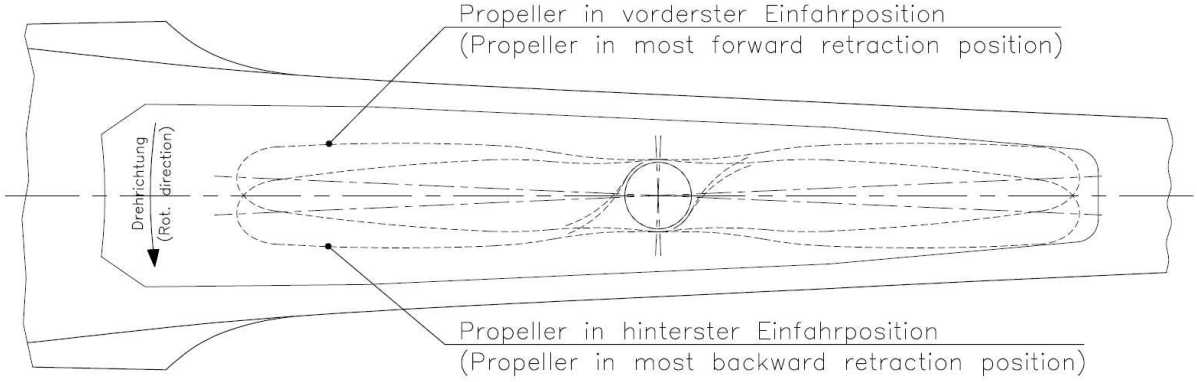
b) Adjusting the operating range of the proximity switches – *front limit* of the retracting area (continued)

vii) As soon as the brake servo has automatically opened again continue to turn the propeller slowly. The movement of the propeller is then delayed by a pulsed braking of the brake servo.

viii) Move the propeller slowly by hand to the front limit of the retracting area. Check with the aid of the LEDs on the proximity switches which proximity switch reacts first (LED turns off). When the LEDs on both proximity switches have turned off, the powerplant will retract automatically after a short break.
If necessary, check the breaking force of the brake servo on the propeller during the retraction process, see section 5.5.7.

ix) Stop the automatic retraction process shortly before reaching the cut out for the engine compartment by pressing the manual operation switch. Then carefully continue retraction of the power-plant with the manual operation switch and check the clearance between the critical rear propeller blade and the cut out for the engine compartment:

- The propeller blade must not touch the cut out of the engine compartment.
- The clearance between the propeller and the engine compartment cut out should not be more than 10 mm (0.394 in), to avoid needless reduction of the retracting area.



5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.6 Adjusting the operating range of proximity switches for the automatic propeller brake (continued)

b) Adjusting the operating range of the proximity switches – *front limit* of the retracting area (continued)

x) If the distance between the propeller and parts of the fuselage doesn't correspond with the nominal dimensions, proceed as follows:

No. I) Propeller is stopped too early (propeller trailing edge touches the engine compartment cut out)

Operating sequence of proximity switch POS1 and POS2 (LED off)	Measure
Pos1 reacts before Pos2	Move the proximity switch that reacts first into the direction of rotation of the propeller.
Pos2 reacts before Pos1	
Pos1 and Pos2 react simultaneously	Move entire attachment into the direction of rotation of the propeller.

No. II) Propeller is stopped too late (propeller trailing edge has large clearance to the engine compartment cut out)

Operating sequence of proximity switch POS1 and POS2 (LED off)	Measure
Pos1 reacts before Pos2	Move the proximity switch that reacts last into the direction of rotation of the propeller.
Pos2 reacts before Pos1	
Pos1 and Pos2 react simultaneously	Move entire attachment against the direction of rotation of the propeller.

Note:
If the adjusting range of the single proximity switches in their mounting is no longer sufficient, the complete attachment bracket has to be moved. Only when this option is no longer sufficient, the holes in the attachment can be expanded.

Caution:
The correct adjustment of the retracting area front limit must be checked in both retracting positions of the propeller (displaced by 180°).

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.6 Adjusting the operating range of proximity switches for the automatic propeller brake (continued)

c) Adjusting the operating range of the proximity switches – *rear limit* of the retracting area

i) At first follow the same procedure as described in section 5.5.6 b) i) to vii).

ii) When the propeller has reached the retracting area (brake servo brakes permanently after pulse breaking) increase the manual force on the propeller further until the propeller slips despite the applied propeller brake. Slowly move the propeller to the rear limit of the currently selected retracting area.
The started automatic retraction process will be stopped, when the rear limit of the retracting area is exceeded (LED lights up again).
Then move the propeller slowly backwards against the direction of rotation until the automatic retraction process is started again (both LEDs off).

iii) Then proceed as described in section 5.5.6 b) ix) for the evaluation of current setting of the rear limit of the retracting area.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.6 Adjusting the operating range of proximity switches for the automatic propeller brake (continued)

c) Adjusting the operating range of the proximity switches – *rear limit* of the retracting area (continued)

Iv) If the distance between the propeller and parts of the fuselage doesn't correspond with the nominal dimensions, proceed as follows:

No. III) Propeller pivots too far (propeller leading edge touches the engine compartment cut out)

Operating sequence of proximity switch POS1 and POS2 (LED on)	Measure
Pos1 reacts before Pos2	Move the proximity switch that reacts last against the direction of rotation of the propeller.
Pos2 reacts before Pos1	
Pos1 and Pos2 react simultaneously	Move entire attachment against the direction of rotation of the propeller.

No. IV) Retracting area is not utilised (propeller leading edge has large clearance to the engine compartment cut out)

Operating sequence of proximity switch POS1 and POS2 (LED on)	Measure
Pos1 reacts before Pos2	Move the proximity switch that reacts first into the direction of rotation of the propeller.
Pos2 reacts before Pos1	
Pos1 and Pos2 react simultaneously	Move entire attachment into the direction of rotation of the propeller.

Note:
If the adjusting range of the single proximity switches in their mounting is no longer sufficient, the complete attachment bracket has to be moved. Only when this option is no longer sufficient, the holes in the attachment can be expanded.

Caution:
The correct setting of the rear limit for the retracting area must be checked in both retracting positions of the propeller (displaced by 180°).

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.6 Adjusting the operating range of proximity switches for the automatic propeller brake (continued)

d) Completion of adjusting the operating range of the proximity switches

After completing the adjustments, tighten the screw connection of both proximity switches and of their attachment.
Secure both connections with Loctite.

Caution:
The maximum tightening torque for screwing the nuts on the proximity switches is 10 Nm (7.38 lbf ft).
If this torque is significantly exceeded the proximity switches will be damaged!

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.7 Checking the brake efficiency of the automatic propeller brake

The brake efficiency of the automatic propeller brake can be checked on the ground according to the following procedure:

a) Requirements:
- Battery of the powerplant system must be completely charged.
- Keep at hand spring scale or similar device for force measurement (working range up to min. 100 N [22.481 lbf], resolution at least 5 N [1.124 lbf])
- Attach a narrow tape loop or something similar to one propeller tip. (distance of the measuring point to the rotation axis of the propeller about 760 mm [29.921 in])

b) Switch ignition OFF and completely extend powerplant. Turn the propeller by hand about 20° against the direction of rotation out of the retraction area, so that both sensor plates at the upper belt pulley are completely outside the proximity switches.

c) Attach the spring scale to the intended position at the propeller tip.

d) Switch ignition ON. Then switch Ignition OFF again and press the MENU-button to start the automatic retraction process.

e) Carefully apply test force perpendicular to the propeller blade in the propeller plane and move the propeller over the pulse brake area to the retracting area until the automatic retracting starts.

f) During the automatic retraction process the brake servo operates with maximum power. Increase the test force on the propeller blade carefully during this process until the propeller starts to slip. Required force on the propeller when the brake just starts to slip: **at least 40 N** (8.993 lbf).

Caution: The automatic retraction process will be stopped not before the retraction area rear limit is exceeded!

g) If the minimum force is not met, the following points have to be checked first before any further action is taken:
- Check condition of brake pad and brake drum (contamination, damage)
- Check adjustment of drive lever at brake servo according to section 5.5.4.
- Bowden cable of brake servo clear and not damaged?
- If brake servo was removed / replaced: Check correct polarity of brake servo ports (→ direction reversing!).
- Check electrical connections of the brake servo:
- Check plug contact to electrical series resistor in engine compartment for proper contact.
- Check contact resistance of the power supply to the brake servo.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.8 Other settings, wear limits and play

a) Readjustment of manual propeller brake

- If the specifications for the basic adjustment given in section 5.5.3 are met, the readjusting of the manual propeller brake is not required.

- The Bowden cable must be replaced if wear of the cable is visible.

b) Readjustment of automatic propeller brake

To rate the automatic propeller brake first move the brake lever in the position described in section 5.5.2. Readjusting the automatic propeller brake is required as soon as the gap between the brake pad and the brake drum is outside the allowable range (dimension “a” in diagram on page 5.5.2.2).

In case of suspected poor brake efficiency, proceed as described in section 5.5.7.

The Bowden cable must be replaced if wear of the cable is visible.

c) Wear of brake pad

Regardless the gap between brake pad and brake drum determined as described in 5.5.2 b) the remaining thickness of the brake pad must be above the specified minimum value (dimension “b” in diagram on page 5.5.2.2). Otherwise the brake pad has to be replaced.

Small breaks on the edges of the brake pad are tolerable.

In case of poor brake efficiency and suspected overheating or strong contamination of the brake pad, the brake pad has to be replaced.

5.5 Maintenance of manual and automatic propeller brake (continued)

5.5.8 Other settings, wear limits and play (continued)

c) Wear of brake pad: (continued)

Caution:

If a new brake pad is installed, it is recommended to prepare the brake pad before adjusting the propeller brake system as follows.
For the preparation install the new brake pad at the brake lever and check that the brake pad is clear of the brake drum.
Then start the engine and with engine idling pull gently the manual propeller brake handle for about 2s and release the propeller brake again.
The procedure is finished when the contact surface on the brake pad is about 10 mm to 15 mm wide.

5.6 Pylon arresting wire for the powerplant

5.6.1 Replacing the pylon arresting wire

a) Disassemble arresting wire from the propeller pylon.

b) Remove bolts attaching cable guide to rear wall of engine compartment.

c) Pull arresting wire (with its guide) forward until attached rubber cord becomes visible.

d) Loosen the knot with the rubber cord and fix the rubber cord in place.

If the rubber cord has to be replaced:

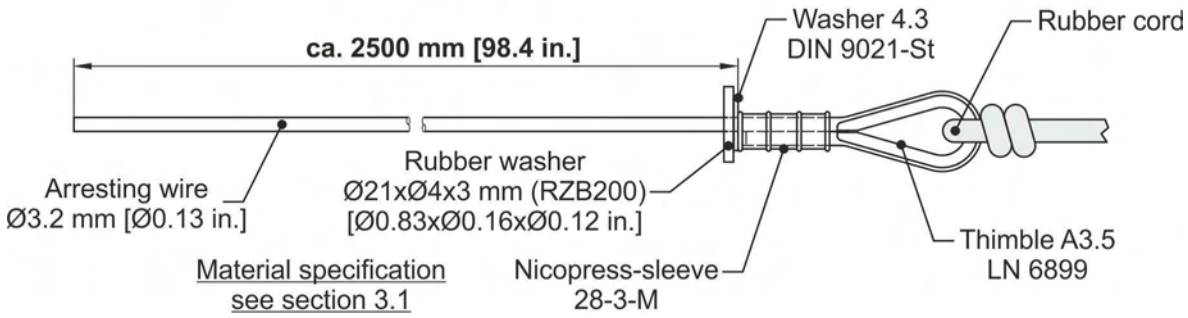
1.) Pull the old rubber cord clear to the rear (towards top of the fin)

2.) Connect a thin wire (or the like) with a length of approx. 4000 mm (157 in.) with the new rubber cord. Secure the end of the rubber cord with a knot. Then insert the wire from the rear into the guide tube in the fuselage and pull rubber cord into position. Tie front end of rubber cord to thimble on arresting wire (see item e) below).

3.) Adjusting the tension of the rubber cord:
Retract powerplant with arresting wire released. Pull rubber cord to the rear until arresting wire is just straight. Then secure rubber cord in place (2 opposing knots) and cut off excessive length.

e) Prepare new arresting wire with additional length. Then connect the new arresting wire with the rubber cord as shown in the sketch below.

Arresting wire hook up in engine compartment



Connect rubber cord to the thimble with 2 opposing knots and let it slide into the fuselage.

5.6 Pylon arresting wire for the powerplant (continued)

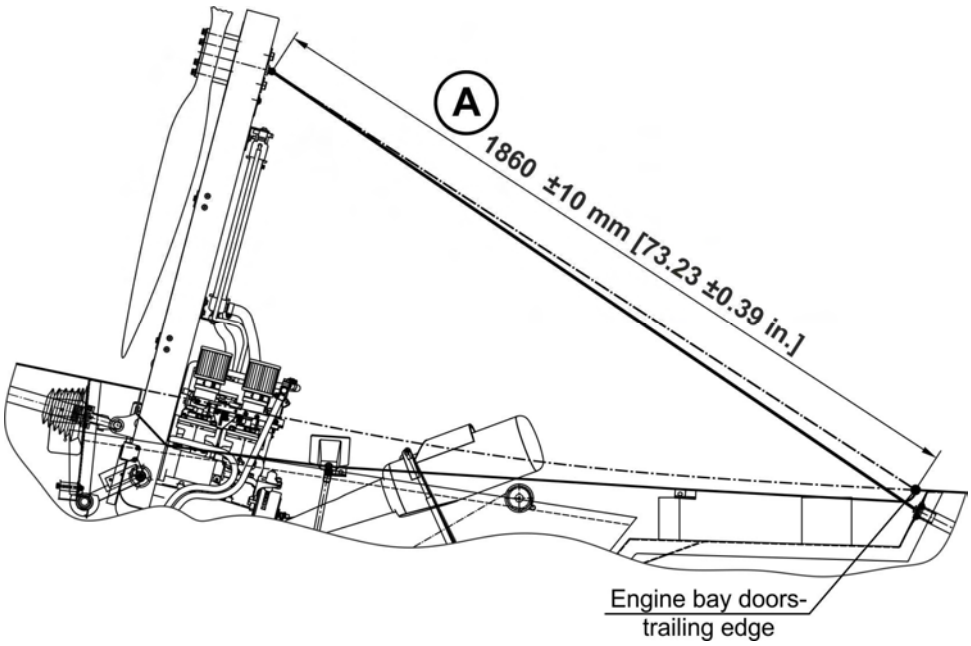
5.6.1 Replacing the pylon arresting wire (continued)

f) Reinstall cable guide for the arresting wire in the engine compartment and connect the arresting wire to the propeller pylon as follows:

Extend the propeller pylon completely using the Manual Operation switch. When the spindle drive has been cut off automatically by the limit switch check the following items:

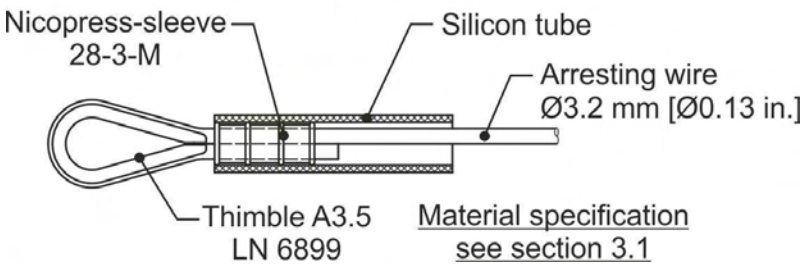
- dimension “A” shown in the sketch below must be fulfilled
- the arresting wire must have left about 10-15 mm (0.394 in-0.591 in) way before its stop rests against the fuselage bulkhead.

If these requirements are not fulfilled the limit switch attached to the spindle drive has to be readjusted (see section 5.7).



g) Guide the arresting wire through the eyelet of the mounting bolt and connect it with the thimble and the Nicopress sleeve as shown in the sketch below:

Arresting wire hook up at powerplant



5.6 Pylon arresting wire for the powerplant (continued)

5.6.2 Installation of arresting wire

As arresting wire for the powerplant a closed wire rope is used (see section 3.1.2).

If the mounting bolt of the arresting wire at the propeller pylon is loosened and reinstalled afterwards, it must be ensured that after the installation to the propeller hub the arresting wire is not twisted compared to the loosened state.
Otherwise the service life of the arresting wire can be decreased and the sliding of the arresting wire into the fuselage while retracting the powerplant can be hindered.

To avoid this situation it is necessary to twist the mounting bolt for the arresting wire before it is screwed to the propeller hub: Turn the arresting wire with the same number of turns against the direction of the thread as it will be turned while screwing in.
For this purpose take a note with the number of turns when the mounting bolt for the arresting wire is removed.

5.7 Adjusting propeller pylon limit switches and engine bay doors

1. Configuration “Powerplant extended”
   (Limit switch mounted to spindle drive)

   - Carefully extend propeller pylon with the emergency switch (see Flight Manual section 7.3) until the spindle drive just comes to its stop (see section 5.13).
   - Then retract propeller pylon again until the arresting wire is loose by 10 to 15 mm (0.394 – 0.591 in.). Propeller pylon position must follow the data from section 5.6)
   - If the green LED on the operating unit does not come with the pylon positioned as described above loosen the limit switch mount on the spindle drive and move limit switch so that the green LED signal “extended” on the operating unit just comes on. Then tighten limit switch mount and secure it in position using Silicone.

   Note:
   With this adjustment the thrust of the prop will pull the arresting wire tight, while the spindle drive is softly supported by rubber vibration isolators.

2. Configuration “Powerplant retracted”
   (Limit switch on the rear bulkhead inside the engine bay)

   - Disconnect actuating rod from doors of engine bay.
   - Retract propeller pylon until it rests firmly against the rubber stop inside the engine bay.
     Warning:
     First check basic adjustment of the limit switch. To avoid damage it must not be fully depressed to the internal stop!
   - The limit switch “powerplant retracted” is accessible through an opening in the bulkhead mentioned above. It is vertically adjustable by turning in or out the two lock nuts such that with propeller pylon resting against the stop, the tappet of the limit switch is tripped but not fully depressed. The green LED signal “retracted” will then come on.
   - Reconnect rod actuating the engine bay doors.

3. Adjusting doors of engine compartment
   (if necessary)

   - Lengthen turnbuckles on door actuating cables such that retracted propeller pylon rests against the rubber stop inside the engine bay (see afore-mentioned “limit switch adjustment”).
   - Thereafter adjust each turnbuckle so that the cables close the doors equally tight.
   - Finally secure turnbuckles.

5.8 Removal and reinstallation of fuel tanks

a) Removal and reinstallation of the fuselage fuel tank

Proceeding for removal of the fuselage fuel tank:

1. Drain all fuel via the drain valve.
2. Remove the rear seat back rest and the panel above the spar stubs.
3. Remove spindle drive including front attachment bracket from the fuselage.
4. Detach the three fuel lines attached to the top of the fuselage fuel tank: Two lines attached at the rear right hand side and one on the left hand side attached to the ball valve, see also Flight Manual section 7.11).
5. Detach fuel line to the drain valve in front of the T-fitting. (left hand side of the landing gear box)
6. Remove fuel line to the fuel cock (located on the fuselage shell on the right hand side below the cut-out for the spar stub).
7. If wing fuel tank(s) is (are) installed:
   Disconnect the attachment for the fuel line(s) to the wing fuel tank(s).
8. Remove wiring of the fuel level meter.
9. Remove the four bolts attaching the fuel tank to the landing gear box and the front engine bay bulkhead. Take care of the spacers (aluminium) and the ground connection cable installed.
10. Move fuel tank backward and upward. Then rotate fuel tank to the front und pull it out from the fuselage upside down. Take care of the fuel lines still attached to the fuel tank.

Proceeding for reinstallation of the fuselage fuel tank

Reverse the steps for removal of the fuselage fuel tank given on page 5.8.1 when reinstalling the fuel tank. In addition take care of the following items:

Item 5, 6: Fuel lines to the fuel cock and the drain valve must carefully be routed in the original way. Check for sufficient clearance to the controls.

Item 9: Take care of the correct installation of the spacers! Do not forget the connection of the ground strap!

5.8 Removal and reinstallation of fuel tanks (continued)

b) Removal and reinstallation of the wing fuel tank model HFK-TLF

(see also sketch on page 5.8.5)

Proceeding for removal of the wing fuel tank:

1. At the root rib:
   - Ventilation line: Remove heat shrink tubing and securing wire from the fitting and remove the short ventilation line with plug nipple.
   - Fuel line: Unscrew the male coupling and the bush of the fuel line fitting.
   - Loosen nut of the fittings using a socket wrench.
   - Install an extension tubing (e.g. instrument tubing) with a length of about 2.5m (8.2 ft) to the fittings (tie a knot on the free end). To attach the extension tubing to the fuel line fitting a different size of tubing is required than for the ventilation line. Remove the nuts.
2. Turn wing panel upside down:
   - Remove access plate for the wing fuel tank compartment.
3. Release attachment of the wing fuel tank inside the wing:
   - Remove nut, washer and ground strap from the suspension bolt located on the rear side of the wing fuel tank and lift off fuel tank from the suspension bolt.
   - Detach fuel tank attachment rope from the eyelet on the lower wing shell.
4. Removal of the wing fuel tank:
   - Fold tank in spanwise direction while pulling it out through the access opening.
   - Let attachment rope uncoil into the wing panel while fuel tank is pulled out. Simultaneously feed extension tubing through root rib.
5. When the fuel tank is replaced:
   - Detach extension tubing and attachment rope from the inboard end of the fuel tank and tape loose ends to the wing shell.
   - Fix opposite end of the attachment rope to the fuel tank retaining eyelet.
6. If required inspect fuel tank according to „Inspection instruction for flexible fuel tanks model HFK-TLF“ (section 9).
7. Inspect accessible wing fuel tank compartment of the wing panel for damage.

5.8 Removal and reinstallation of fuel tanks (continued)

b) Removal and reinstallation of the wing fuel tank model HFK-TLF (continued)

Proceeding for installation of the wing fuel tank:

If the wing fuel tank is to be replaced by a new fuel tank first prepare the fittings of the new fuel tank:

- Connect fuel line to wing fuel tank. Take care of tight and strong connection. Use securing wire and heat shrink tubing to secure the fuel line attachment.
- Connect ventilation line with the extension nipple. Take care of tight and firm connection. Use securing wire and heat shrink tubing to secure the fuel line attachment.

Reverse the steps for removal of the wing fuel tank given on page 5.8.2 when reinstalling a (new) wing fuel tank. In addition take care of the following items:

1. When pulling the tank back home, make sure that the instrument tubing on fuel line, ventilation line and the attachment rope do not become entangled – route them parallel.

2. Make sure that the O-ring sealing on the fittings in the root rib is on place and that they are slightly lubricated (use acid free grease or Vaseline).

3. If a new wing fuel tank is installed:
   - Connect attachment rope to the grommets on the corners of the fuel tank (Attachment rope is guided twice through the grommet and tied with a square knot. Secure knots using instant adhesive)
   - If the extension tubing has been removed: Attach extension tubing to the fittings.

4. When inserting the fuel tank:
   - Pull fuel tank home by the attachment rope. Simultaneously pull out extension tubing through root rib.
   - Pull spanwise folded fuel tank through the access opening.

5. Unfold the fuel tank to it’s true size when it has passed the access opening. It must lay flat when pulled fully home so that finally the wing water ballast guide tube is between fuel tank and wing shell.

6. Fuel tank attachment when the fuel tank has been fully pulled home:
   - Hook up fuel tank grommet to the retaining stud in the wing shell.
   - Reinstall ground strap, washer and nut. Tighten nut with care.

5.8 Removal and reinstallation of fuel tanks (continued)

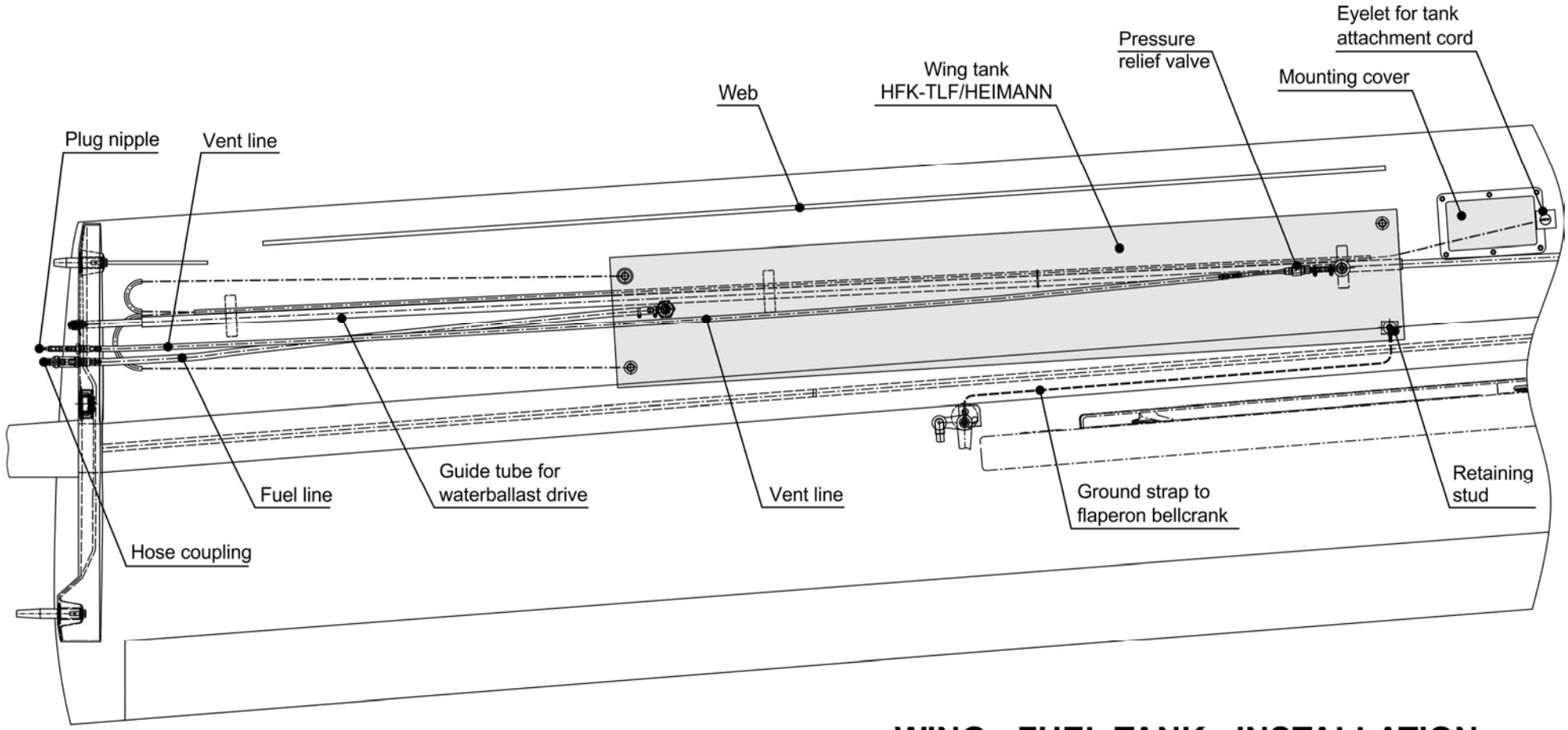
b) Removal and reinstallation of the wing fuel tank model HFK-TLF (continued)

7. Tighten fuel tank attachment rope carefully and secure it to the eyelet on the lower wing shell (fix attachment rope following description from page 5.8.3). Roll up free end of the rope and fix it to the eyelet, too.

8. After Installation of the fuel tank compartment access plate:
   - Mask screw heads and the edges of the access plate with tape.

9. Installation of fuel line and ventilation line at the root rib:
   - Feed hose nipples through their openings in the root rib and install retaining nut.
   - Make sure that fuel line and ventilation line are not routed below the wing water ballast guide tube. If necessary rotate hose nipple to alter position.
   - Detach extension tubing from nipples. Tighten retaining nut and secure with Loctite 243.
   - Attachment of the fuel line (backward fitting):
     Install the bush and the male coupling of the fuel line fitting. Tighten and secure screwing using Loctite 243.
   - Attachment of the ventilation line (forward fitting):
     Feed heat shrink tube on the short ventilation line with plug nipple and secure ventilation line on the fitting with securing wire.
   - Use a fan heater to tighten the heat shrink tubing.

Caution:
Only use stainless securing wire for the attachment of the wing fuel tank lines to the fittings (see section 4.4).
The access panel may be bolted to the wing panel only with stainless bolts (M5x16 DIN 965 A2).



WING - FUEL TANK - INSTALLATION

(right wing shown, left wing reversed)

5.9 Powerplant – removal and reinstallation

Removal of the powerplant

1. Extend powerplant

   - Remove propeller
   - Dismantle engine bay doors
   - Disconnect tensile spring for the exhaust muffler at the lower end
   - Remove axis (bolt) at the hinge between exhaust manifold and muffler
   - Remove exhaust muffler from the fuselage
   - Close the tubes of the exhaust muffler suspension (otherwise internal compression springs might get lost)

2. Disconnect the throttle cable at the butterfly valve axis (screwed nipple). Remove securing wire from the adjustable Bowden outer suspension and release Bowden outer.

3. Disconnect cables for the propeller brake actuation from the propeller brake lever (screwed nipples). Remove securing wire from the adjustable Bowden outer support and release Bowden outer. Take care of the return spring. Alternative method (screwed nipples need not to be opened): Remove brake lever at the hinge point. Unscrew guiding slot and support for the Bowden outer from the propeller pylon.

4. Disconnect mounting bolt of the powerplant arresting wire from the propeller pylon.

5. With powerplant master switch OFF disconnect positive terminal of starter motor and insulate it carefully.

6. Disconnect the ground strap by removing the bolt attaching the starter motor mounting flange.

7. Powerplant master switch ON. Retract the engine until it is positioned almost in horizontal position. Then put a wooden bloc as suspension on the engine bay bracket and continue retraction of the powerplant until it rests on the wooden bloc

8. Switch powerplant master switch OFF and disconnect plug for the powerplant wiring (bayonet coupling) from the front end engine bay bulkhead.

9. Disconnect the quick-acting coupling for the fuel lines from the front end engine bay bulkhead.

10. Remove attachment bolt between spindle drive and propeller pylon from the propeller pylon and turn in telescopic tube until fully home.

5.9 Powerplant – removal and reinstallation (continued)

Removal of the powerplant (continued)

11. Loosen both pylon mounting bolts (see drawing on page 5.9.4).

12. Attach a hoist to the propeller pylon (at the spindle attachment point), remove pylon mounting bolts (by extracting them inwards – watch for bushings) and lift the powerplant out from fuselage.
    The hoist for lifting the propeller pylon alternatively may be attached directly to the propeller pylon at the position of the ignition boxes.

If the Arcus M shall be operated after with engine removed the following measures have to be accomplished before:

13. Removal of the following parts:

    -Welded attachment bracket for the exhaust muffler

14. Fix loose wiring and parts. Take special care of:

    - Spindel drive
    - Actuation rod for the engine bay doors
    - Loose propeller brake lever and bowden cables
    - Wiring of the starter motor
    - Powerplant arresting wire

15. Reinstall the engine bay doors. Close and seal the engine bay doors (e.g. using white tape, width 19mm / 0.75 in.)

16. Remove large powerplant battery from the fuselage steel frame between front and rear cockpit. Insulate and fix wiring of the battery.

17. Drain all fuel.

18. Check empty mass C/G position and revise loading charts before the next flight (see section 6.8)

    Install required trim ballast according to the results from the C/G calculations. The following locations are available for the installation of trim ballast in the tail:

    a) Bolt a lead ballast plate to the rib at the top of the fin.

    b) Install an additional battery in the fin battery compartment.

    c) Use a tail wheel hub with additional weight (ZRB181, available from Schempp-Hirth).

5.9 Powerplant – removal and reinstallation (continued)

Reinstallation of the powerplant

Reverse the steps for removal of the powerplant given on page 5.9.1 and 5.9.2 when reinstalling the powerplant.

Caution:

a) When reinstalling the powerplant use Loctite 243 to secure the following components:

   - Attachment bolts for the powerplant
   - Attachment bolts for the starter motor
   - Bolt for the arresting wire (mind section 5.6.2)

b) Correctly attach the wiring of the starter motor to the propeller pylon.

c) Take care of tight connection and proper installation of the fuel hoses.

d) Ensure correct connection of the electrical wiring without folding and chafing.

e) Connect the throttle cable to the throttle push rod on the left hand side of the fuselage below the cut out for the spar stubs. Connect the linkage only with the powerplant fully extended!

f) Check adjustment of the throttle control: With the powerplant fully extended the butterfly valves must freely reach the mechanical stops for idle and full throttle at the fuel injection system.

g) When the axis for the hinge between exhaust manifold and exhaust muffler is installed make sure that the hinge is easily moveable and does not jam. For adjustment and inspection of the exhaust system see section 5.15.

h) Reinstall components of the propeller brake systems. For adjustment and inspection of the propeller brake system see section 5.5.

Additional requirements:

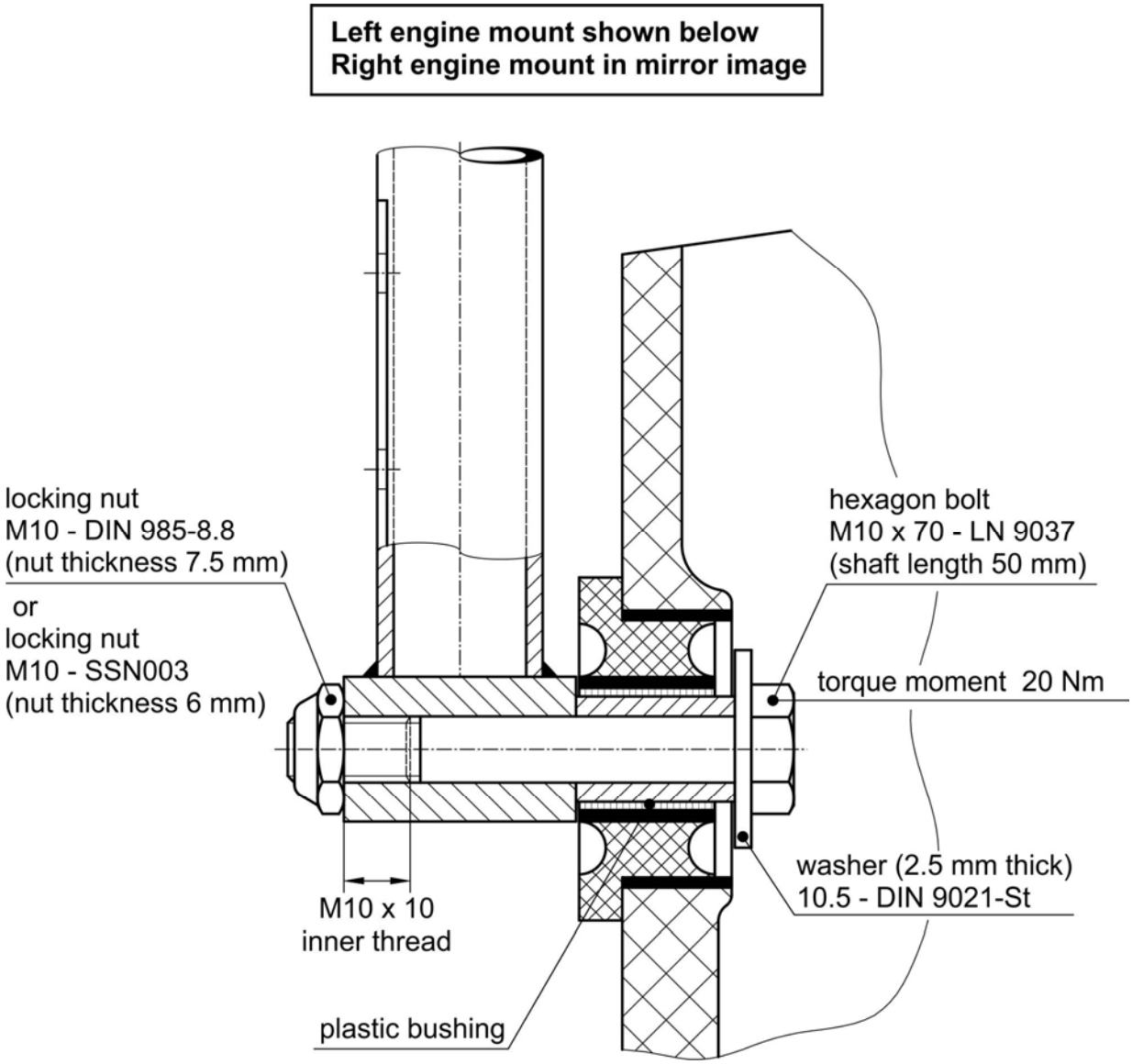
- Conduct an engine test run (see inspection list in the appendix)
- Have the engine reinstallation reviewed and signed in the aircraft's log book by certified review staff.

  Note:
  The applicable regulations issued by the national aviation authority where the glider is registered are not affected by this instruction.

5.9 Powerplant – removal and reinstallation (continued)

Reinstallation of the powerplant (continued)

Installation of propeller pylon mounting bolts



5.10 Removal and installation of the V-belt set

5.10.1 General

Do not handle the V-belt with brute force!
Installation with tools like screw driver or crowbar cause external and internal damage to the V-belt. This strongly affects the service life of the drive belt.

Caution:
The drive belt of the Arcus M consists of a set of five single V-belts.
It is not possible to replace single V-belts. If necessary the V-belts must always be replaced as a complete set.

5.10 Removal and installation of the V-belt set (continued)

5.10.2 Removal of the V-belt set

1) Remove propeller. For this purpose first rotate propeller into horizontal position to avoid collision of the proximity switches and the respective sensor plates on the upper belt pulley during disassembly.

2) Remove the attachment bolt for the arresting wire from the propeller pylon.

3) Remove lever of the propeller brake at the hinge.

4) If you intend to install the same V-belt set afterwards again it is helpful to mark the present position of the eccentric propeller hub on the propeller pylon. In this way it is very simple to restore the original adjustment.
For this purpose it is recommended to copy one of the marks from the rear side of the propeller hub to the propeller pylon.

5) Attach belt adjusting disc (s. section 5.12 and section 11) with bolt M14 at the designated place on the rear side of the propeller hub.

6) Remove attachment bolts of the propeller hub (4 x M12).

7) Release V-belt set tension completely. To accomplish this turn the eccentric propeller hub to the minimum position (with position „-“ on top, see section 5.12 resp. Section 11) with means of the M14 bolt head of the belt adjusting disc. Then remove belt adjusting disc and press out the propeller hub from the propeller pylon to the front.

   Caution:
   When removing the propeller hub take care of the sensor plates for the propeller proximity switches attached to the rear side of the drive pulley. The sensor plates must not be damaged!

8) Pull upper belt pulley from the propeller pylon to the front and downward to release the V-belt set from the pulley.

9) Remove V-belt set from the small (lower) belt pulley.

5.10 Removal and installation of the V-belt set (continued)

5.10.3 Installation of the V-belt set

For the installation of the V-belt set reverse the steps for removal:

1) Route the V-belt set around the small (lower) drive belt pulley.

2) Route V-belt set around the large (upper) belt pulley and insert propeller hub into the propeller pylon. Make sure that the tension of the drive belt is minimum (mark "-" must be positioned on top, see section 5.12).
   Provisionally secure the installation of the large (upper) belt pulley and the propeller hub in the propeller pylon with the belt adjusting disc (see section 5.12).

3) Measurement and adjustment of the V-belt set tension see section 5.11 and 5.12.

4) When the adjustment of the V-belt set is completed tighten and secure the four bolts M12 of the propeller hub (required torque see section 4.4). Dismantle the belt adjusting disc.

5) Screw bolt for the arresting wire into the propeller hub (see section 5.6.2), secure and tighten lock nut.

6) Install brake lever for the propeller brake. For adjustment of the propeller brake see section 5.5.

7) Install propeller, mind the correct position! (see section 5.10.1). Secure propeller bolts with securing wire (Required torque see section 4.4).

8) Check the adjustment of the proximity switches for the automatic propeller brake. If necessary correct the adjustment, see section 5.5.

Caution:
After installation of a new V-belt set there is a increased wear of the transmission gear in the initial operation time.
For this reason in the beginning the V-belt tension has to be inspected in reduced time intervals (see section 4.2.3).

5.11 Measuring the V-belt tension

5.11.1 General

For safe operation of the engine and the transmission gear the drive belt tension always has to be within the permissible range.

For this reason a periodic inspection of the drive belt tension has to be accomplished. When a new drive belt has been installed the inspection interval is reduced at first (see section 4.2.3)

There are two procedures available to check the drive belt tension. Both procedures are described on the following pages.

If the procedure for adjustment of the drive belt from section 5.12 is not sufficient to adjust a proper belt tension within the permissible limits contact the manufacturer for further advice.

5.11 Measuring the V-belt tension (continued)

5.11.2 Procedure 1: Investigation of the V-belt tension by deformation measurement

a) Requirements for the investigation

- The device for measuring the V-belt tension must be available (s. section 11).
- Spring scale with an effective range up to 100N (22.481 lbf).
- Powerplant must have a temperature of about room temperature (18-23°C) (64.4-73.4°F).
- Before the measuring is started turn the propeller several times by hand.
- Check the drive pulleys and each single V-belt for visible damage.
- The measuring of the V-belt tension is done on the left hand side of the V-belt set between the track-supporting rollers.

b) Measuring method

1) Extend powerplant completely.

2) Turn propeller against rotational direction to have access to V-belts.

3) Place measuring device on the V-belt set in the middle between the track-supporting rollers. All single V-belts must be included in the measurement.
Apply test load of 100N (22.481 lbf) in the middle of the device perpendicular to the plane of the V-belt set. Measure the position of the V-belt set first at rest and then when the test load is applied. The determined deformation must be within the following limits:

Determined deformation	Remark
9 mm (0.354 in.)	Lower limit of the V-belt tension in operation (Readjustment strongly recommended).
9 mm > …> 6 mm (0.354 in.- 0.236 in.)	Normal operation range after run-in phase (see section 4.2.3)
6 mm (0.236 in.)	Upper limit of the V-belt tension in operation (Adjustment of a new V-belt set before first operation because of increased wear during run-in phase)

5.11 Measuring the V-belt tension (continued)

5.11.3 Procedure 2: Investigation of the V-belt tension with use of a frequency meter

a) Requirements for the investigation

- Frequency meter must be available (s. section 11)
- Powerplant must have a temperature of about room temperature (18-23°C) (64.4-73.4°F)
- Before the measuring is started turn the propeller several times by hand.
- Check the belt pulleys and each single v-belt for visible damage.
- Make sure that all single V-belts are correctly supported by the track-supporting rollers.
- The measuring of the natural frequency of the V-belts is done on the left hand side of the V-belt set between the track-supporting rollers.

b) Measuring method

1) Extend powerplant completely.

2) Turn propeller against rotational direction to have access to the V-belts. The propeller may not be turned further before the measurement is completed to avoid any falsification of the measuring.

3) Proceeding:

   Bring the microphone of the frequency meter close to the single V-belt you want to investigate. Make the V-belt oscillate by picking it with the finger or another suitable device. Make sure that always only one of the single V-belts is oscillating. If necessary the single V-belts may be separated from each other for a small amount before the measurement is started.

4) Measuring the belt tension on a single V-belt

   Make in series three measurements per every single V-belt and note the natural frequency determined by the frequency meter. The measurement is reliable when the deviation of the highest and lowest frequency does not differ more than 1Hz from the arithmetic average. If the difference is larger the measurement for this specific single V-belt must be repeated.

5.11 Measuring the V-belt tension (continued)

5.11.3 Procedure 2: Investigation of the V-belt tension with use of a frequency meter (continued)

5) Averaging the natural frequency for a complete set of single V-belts

The natural frequency of every single V-belts determined according to 4) may not deviate more than ± 5Hz from the arithmetic average of all single V-belts. If the difference is larger check again if the single V-belts fulfil the requirements from a). Especially check the single V-belts and the drive pulleys for any significant wear.
The arithmetic average of the natural frequencies of all single V-belts may not exceed the following limits:

Arithmetic average of the determined natural frequencies of the single V-belts	Remark
80 Hz	Lower limit of the V-belt tension in operation (Readjustment strongly recommended).
approx. 85 - 90Hz	Normal operation range after the run-in phase (see section 4.2.3)
95 Hz	Upper limit of the V-belt tension in operation (Adjustment of a new V-belt set before first operation because of increased wear during run-in phase)

Caution:
The propeller may not be turned before the measurement of the natural frequency of all single V-belts is completed. Otherwise the measuring might be falsified.

Note:
The limits for the V-belt tension mentioned in section 5.11.3 have been determined with the frequency meter listed in the table in section 11. There is no experience available with frequency meters of other types.

5.11 Measuring the V-belt tension (continued)

5.11.3 Procedure 2: Investigation of the V-belt tension with use of a frequency meter (continued)

6) V-belt natural frequency measurement report (Example)

Arcus M, serial no.:		Date:
Registration:		
Reason for measuring of the V-belt set:		
Total engine operation time / since the drive V-belt set has been installed:	/	

Single V-belt no.	Determined natural frequency per individual measurement [Hz]			Arithmetic average per single V-belt [Hz]	Arithmetic average for the set of single V-belts [Hz]
	1)	2)	3)		
1 (front)					
2					
3					
4					
5					

5.12 Adjustment of the V-belt tension

5.12.1 General

The tension of the V-belts may be adjusted by turning the eccentric hub of the large belt pulley (propeller hub).
To indicate the position of the eccentric hub the rear of the hub shows the following punched-in markings:

Mark	Position of the eccentric hub, when the respective mark is positioned on top
-	Minimum distance between the belt pulleys
0	Mid of the adjustment range
+	Maximum distance between the belt pulleys

Range of adjustment of the eccentric hub: 8 settings (22.5°), from (-) to (+). Start with the (-) marking being at the top of the hub (minimum V-belt tension or V-belt even loose).

The propeller hub is attached to the propeller pylon by 4 bolts M12.

The V-belt tension is to be measured following the procedures given in section 5.11.

For the adjustment of the V-belt tension it is recommended to provide the “belt adjusting disc” (s. section 5.12.4 and section 11).

5.12 Adjustment of the V-belt tension (continued)

5.12.2 Increase of the V-belt tension

To increase the V-belt tension proceed as follows:

1. Remove the bolt for the arresting wire from the rear side of the propeller hub.

2. Attach “belt adjusting disc” (dimensions shown on page 5.12.4) on the rear side of the propeller hub (using a bolt M14).

3. Remove the bolts (4 x M12) attaching the propeller hub.

4. Turn hub with bolt M14 from the “belt adjusting disc” clockwise to the next lug. Then reinstall and tighten bolts of the propeller hub and measure V-belt tension (see section 5.11).

5. Repeat procedure until tension is within the prescribed limits (see section 5.11).

6. When the adjustment procedure is finished secure and tighten the four bolts attaching the propeller hub (see section 4.4).

7. Reinstall, secure and tighten the bolt for the arresting wire (see section 5.6.2)

Warning:
Raise the tension of the V-belt only in small steps.
If the V-belt is overloaded this might cause permanent deformation and both the V-belt and the engine might be damaged!

Caution:
If the proper belt tension cannot be reached, contact the manufacturer for further advice.

Caution:
When the propeller hub has been readjusted always check and if necessary correct the position of the proximity switches for the automatic propeller brake (see section 5.5).

5.12 Adjustment of the V-belt tension (continued)

5.12.3 Decrease of the V-belt tension

To reduce the V-belt tension proceed as follows:

1. Remove the bolt for the arresting wire from the rear side of the propeller hub.

2. Attach “belt adjusting disc” (dimensions shown on page 5.12.4) on the rear side of the propeller hub (using a bolt M14 and a counter nut M14). The counter nut must be located between “belt adjusting disc” and bolt head.

3. Tighten counter nut.

4. Remove the bolts (4 x M12) attaching the propeller hub.

5. Turn hub with bolt M14 counter clockwise to the next lug. Then reinstall and tighten bolts of the propeller hub and measure belt tension.

6. Repeat procedure until tension is within the prescribed limits (see section 5.11).

7. If the adjustment procedure is finished secure and tighten the four bolts attaching the hub (see section 4.4).

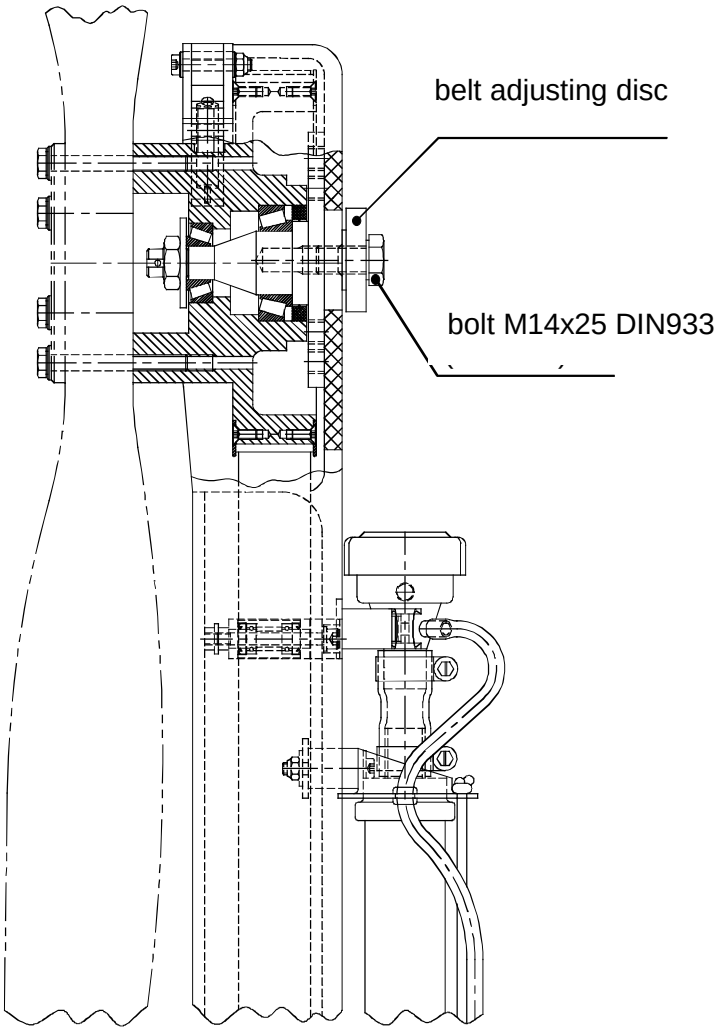
8. Reinstall, secure and tighten the bolt for the arresting wire (see section 5.6.2).

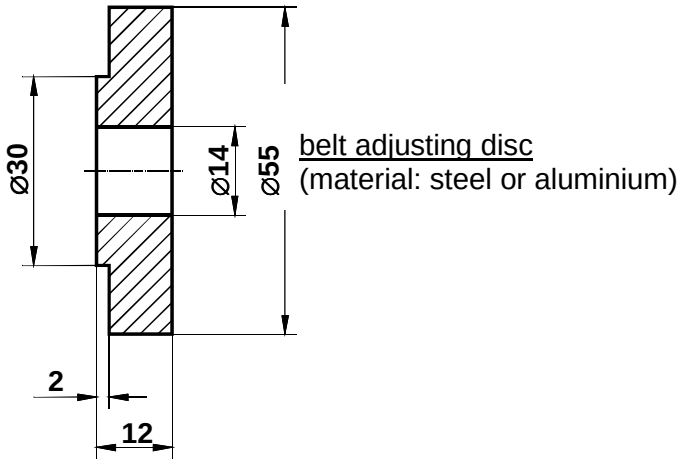
Caution:
If the proper belt tension cannot be reached, contact the manufacturer for further advice.

Caution:
When the propeller hub has been readjusted always check and if necessary correct the position of the proximity switches for the automatic propeller brake (see section 5.5).

5.12 Adjustment of the V-belt tension (continued)

5.12.4 Use of the belt adjusting disc





belt adjusting disc
(material: steel or aluminium)

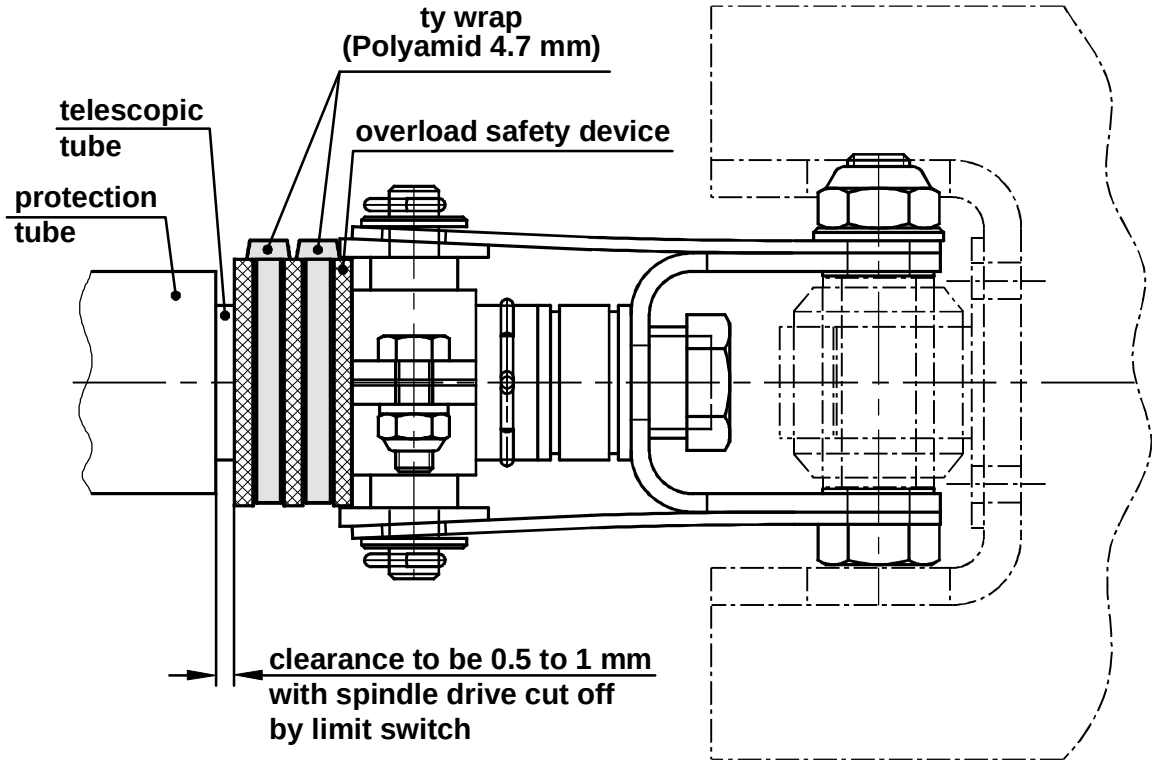
5.13 Spindle drive overload safety device

When extending the power plant, the telescopic tube of the spindle drive is retracted until the latter is cut off by the limit switch “prop extended”.

The overload safety device becomes effective either in the case of a defective limit switch or when the propeller pylon is extended via the emergency switch (the limit switch “prop extended” is then overridden). With the overload safety device resting against the protecting tube, the circuit breaker will trip, thus preventing damage to the spindle drive or other parts. Thereafter the plastic sleeve is to be inspected for proper position or defects.

The overload safety device consists of a 2-piece plastic sleeve attached to the telescopic tube by means of two tie wraps. Dimensions and adjustment of the overload safety device are defined by the following requirements:

- When the propeller pylon is extended with the emergency switch and the circuit breaker has tripped the propeller pylon arresting wire (adjusted according to the instructions from section 5.6) may be just tight respectively loose for max. 3 mm (0.118 in).
- In normal operation the overload safety device must not rest against the protecting tube with the spindle drive cut off by the limit switch (required clearance see sketch below).



5.14 Removal and filling the coolant liquid

5.14.1 Removal of the coolant liquid

1. Fully extend the powerplant, engine must be cold.

2. a) Remove transparent hose for visual indication of the coolant level from the filler cap and plug the hose.

   b) Dismantle the transparent hose from the propeller pylon down to the connection to the aluminium coolant manifold on top of the engine.

3. Route the transparent hose into a container (min. 2 litre contents) placed at the bottom of the engine compartment and remove the plug. For best draining retract the powerplant as far as possible.

4. To drain the coolant system completely:

   a) Extend the powerplant again.

   b) Remove the M10x1 Allen head screw with sealing from left hand side of the aft cylinder head. Mount a suitable nipple M10x1 with connected hose.

   c) Retract the powerplant as far as possible and drain the remaining coolant liquid.

   d) When all coolant liquid has been drained:

      Open the red protecting cap of the emergency system (then the coolant pump is in permanent operation, s. FM page 7.3.8 et seq.). Operate the coolant pump for a short period of time (!) to dump the leftover coolant liquid.

5.14 Removal and filling the coolant liquid (continued)

5.14.2 Filling the coolant liquid

1. Coolant liquid

Approximately 1,8 litre (0.476 US Gal. / 0.396 UK Gal.) of coolant liquid is required.
The coolant liquid used is a mixture from antifreeze fluid and water:

Name	Standard antifreeze fluid (e.g. Glysantin BASF G48)	Demineralised water or tap water (Water hardness 0-20°dH)
Mixing ratio (volume per cent)	**40**	**60**

Example: Mixture as listed above with Glysantin BASF G48 and tap water provides antifreeze protection to approx. -25°C (-13°F).

Caution:

The coolant liquid used must be suitable for engines built from aluminium. It is advised not to use distilled water.

Caution:

The given value for the antifreeze protection has proved to be useful in flight operation. In case of longer parking and depending on the expected environmental conditions it might be necessary to adjust a stronger antifreeze protection.

A high percentage of antifreeze liquid reduces the cooling efficiency of the coolant liquid. For this reason it can be helpful to reduce the amount of antifreeze fluid in the coolant liquid if the engine is operated for a longer period of time at high outside air temperatures.

5.14 Removal and filling the coolant liquid (continued)

5.14.2 Filling the coolant liquid (continued)

2. Fully extend the powerplant.

3. If the coolant liquid has been drained before according to the procedure described in section 5.14.1:
   a) Reinstall M10x1 Allen head screw with sealing ring on left hand side of the aft cylinder head (Torque 20Nm / 14.4lbft).
   b) Reinstall and attach the transparent hose. Refer to item 2.a) und 2.b) from section 5.14.1.

4. Remove the screw cap from the radiator and fill in the coolant liquid until the radiator is completely filled.

5. a) Pull circuit breaker for the spindle drive.
   b) To run the water pump lift the red protection cap of the emergency switch (permanent operation of the water pump!).
   c) Check the visible amount of coolant liquid. The coolant liquid level should be approx. 10mm above the upper end of the radiator cooling fins. If necessary top up the radiator.
   d) Close the radiator cap.

6. a) Perform a ground run (see appendix, inspection lists)
   b) Allow the engine to cool down.
   c) Check the level of the coolant liquid. If necessary fill in coolant liquid up to the specified level.

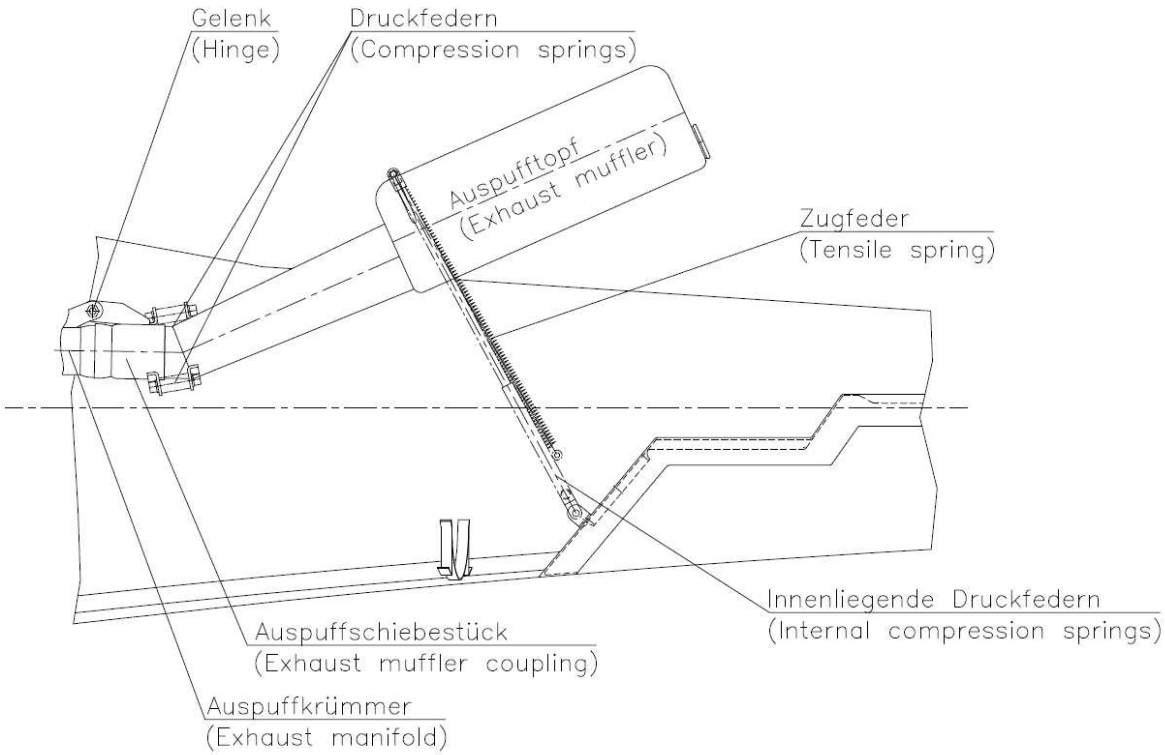
5.15 Adjustment of the exhaust system

5.15.1 Description

During extension and retraction of the powerplant the exhaust system is folded at a hinge located between exhaust manifold and exhaust muffler. The suspension rods of the exhaust muffler are spring-loaded bedded for adjustment purposes and to reduce the vibration loading on the system.

With the engine extended the sealing of the coupling is provided by a ball socket connection. The spring loaded exhaust muffler coupling additionally helps to seal the connection.

The engine performance strongly depends on the sealing between exhaust muffler and exhaust manifold. For this reason a particular arrangement and initial load of the coupling is required to guarantee sufficient sealing of the connection during engine operation.



5.15 Adjustment of the exhaust system (continued)

5.15.2 Basic adjustment of the exhaust muffler

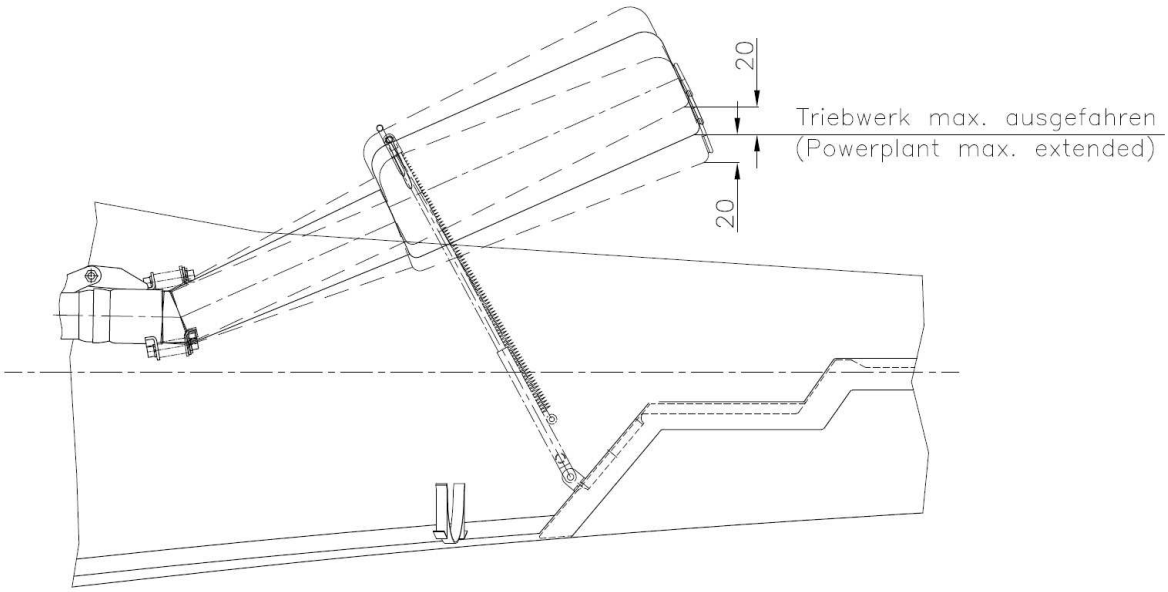
1) First the fully extended position of the power plant must be established correctly before the adjustment of the exhaust muffler can be estimated. For this purpose first check and if necessary correct the adjustment of the arresting wire and the limit switch for the extended position according to the instructions from section 5.6.and 5.7.

2) With the powerplant fully extended press forward (in direction of flight) the propeller pylon at the upper end by hand until the arresting wire is tight. For the following checks the powerplant always must be fixed in this most forward position.

   i) The exhaust muffler is adjusted correctly if it can be moved up and down for at least 20mm (0.787in) with the power plant in the most forward position. When the exhaust muffler is moved within the given range the following characteristics must be fulfilled:

      - there may be no visible movement of the ball-socket connection between exhaust manifold and exhaust muffler and
      - the travel of the exhaust muffler may not be blocked by jamming or a limit stop.

      Especially mind the free movement of the suspension rods in their guiding tubing. Also the hinge between exhaust muffler and exhaust manifold may not jam. Also check the hinge axis for excessive wear.

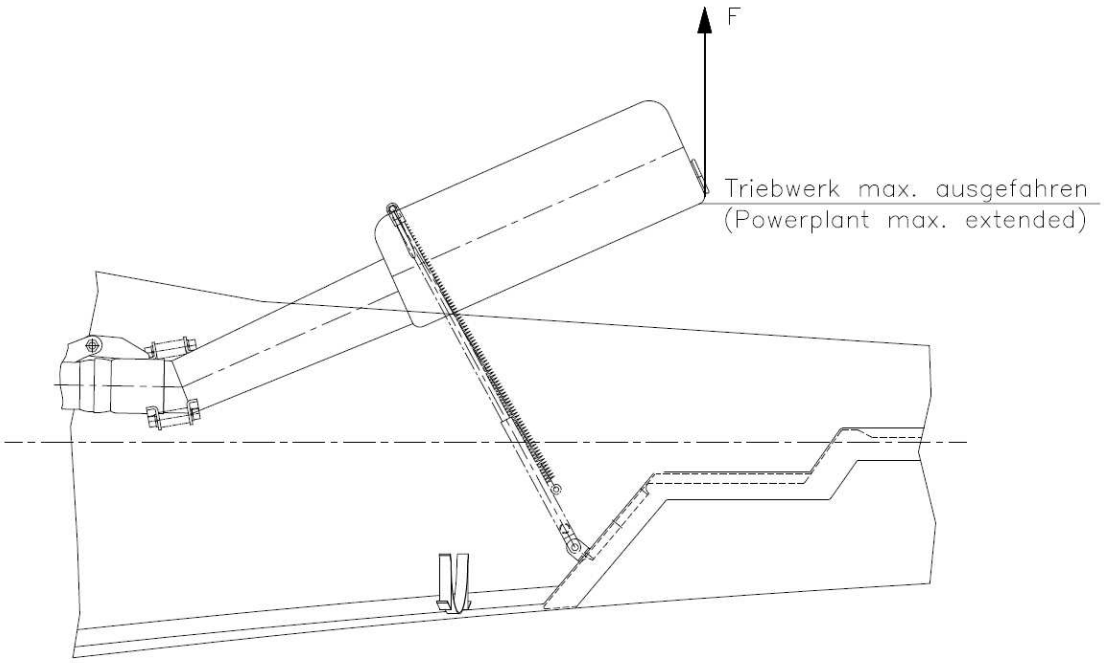


5.15 Adjustment of the exhaust system (continued)

5.15.2 Basic adjustment of the exhaust muffler (continued)

ii) The exhaust muffler is adjusted correctly if a force in the range from **F = 10 to 30N** (2.248 to 6.744 lb f) is just sufficient to set the exhaust muffler in upward motion with the power plant in the most forward position.
The test load must be applied following the sketch below at the rear end of the exhaust muffler in the centre plane of the suspension rods. Force measurement is done by a spring scale.

iii) The adjustment of the exhaust muffler can be corrected by changing the length of the internal compression springs inside the guiding tubing. For adjustment there have to be installed longer springs or the installed springs have to be shortened.



Caution:
The hinge axis between exhaust muffler and exhaust manifold consists of a bolt, a curved spring washer and a special nut similar to DIN 14440.
Tighten the nut only so far that you are just able to turn the axis by hand.
When the nut has been unscrewed always use a new nut for the reassembly of the hinge.

6. Determination of centre of gravity and payload

6.1 Introduction

This section contains procedures for determining the aircraft's empty weight (mass) and empty weight c/g position.

Furthermore it provides procedures for the determination of the c/g position in flight and the permitted payload.

A comprehensive list of all equipment available is found in section 7.

6.2 Weighing procedures

To determine the c/g position of the aircraft main wheel and tail wheel (or skid) are placed on a scale and jacked up such that the attitude shown below is achieved.

The weight on main wheel (W_1) and tail wheel (W_2) is read with the wings held level.

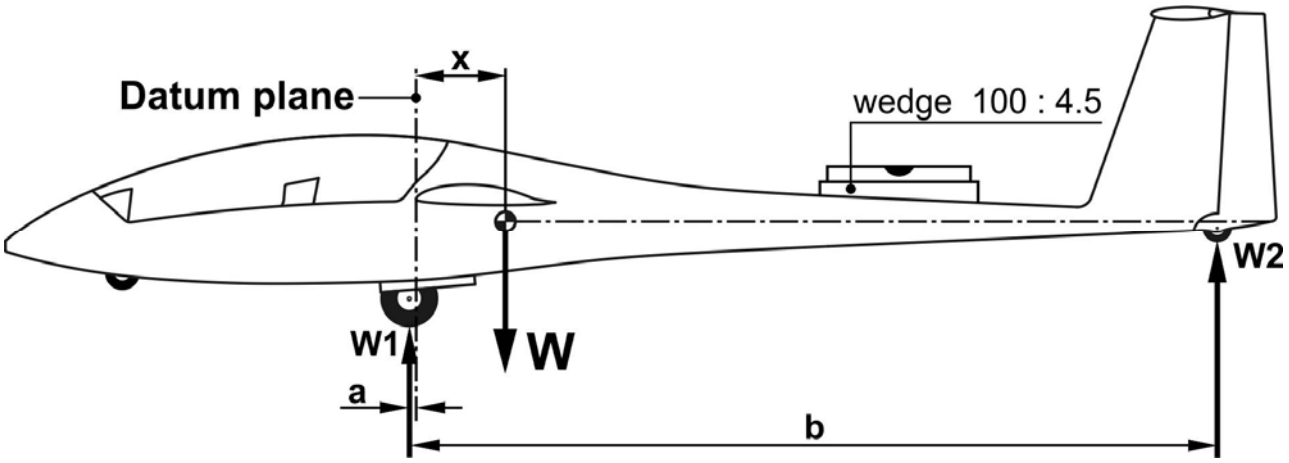
The distances “a” and “b” shall be measured with the aid of a plumb line. Alternatively they can be extracted from the last weight and balance report or from the information provided on the next page.

6.2.1 Empty weight and empty weight c/g position

The empty weight $W= W_1 + W_2$ of the aircraft is determined by weighing.

The empty weight weighing should be accomplished with the complete aircraft without crew, without parachute(s), without fuel and without water ballast, but including all of its fixed equipment. For the weighing the canopy should be closed and the powerplant should be retracted.

For the weighing procedure, the nose wheel must always be installed. If the optional nose skid is installed it must be replaced by the nose wheel for weighing.



Datum plane: Wing leading edge at root rib

6.2 Weighing procedures (continued)

Datum plane: Wing leading edge at root rib

Aircraft attitude: The tail should be jacked up so that a 100:4.5 wedge placed on top of the tail boom is horizontal along its upper edge.

Distance datum to main wheel: a = - 20 mm (- 0.79 in.)

Fixed tail wheel/skid (if installed):

Distance tail wheel to main wheel: b = 5322 mm (209.53 in.)

Steerable tail wheel (if installed):

Distance tail wheel to main wheel: b = 5577 mm (219.57 in.)

Empty mass C/G position: $$x = \frac{W_2 \times b}{W} + a$$

6.2.1 Flight mass and C/G position in flight:

(Given only in case the “c/g position in flight” is to be determined by weighing rather than by computing it on the basis of the empty mass c/g position)

For the flight mass weighing the aircraft is to be weighed fully equipped (crew with parachute(s) and complete equipment incl. barograph, cushions, cameras, fuel, water ballast, etc.). Rudder pedals and seat back rest should be correctly adjusted for this purpose.

C/G position in flight: $$x_{inFlight} = \frac{W_{2,loaded} \times b}{W + W_{payload}} + a$$

Where

W = Empty weight
$W_{2,\ loaded}$ = Measured weight on the tailwheel/skid when weighing with flight mass
$W_{payload}$ = Weight of crew with parachutes, all non-fixed equipment, fuel, water ballast

6.3 Weighing record

It is always necessary to establish the empty mass and the empty mass c/g position of the aircraft on the following occasions:

- after installation of additional fixed equipment
- after repainting
- after repairs
- after any modification which could possibly affect the weight of the aircraft

An authorized inspector has to fill in the empty mass, the empty mass c/g position and all loading data derived from these values on the loading chart. Notes should be made of the equipment installed when the weight of the aircraft is determined – see valid equipment list of the aircraft and Flight Manual page 6.2.3 resp. 6.2.4.

6.4 Empty mass and empty mass c/g position

a) Empty mass

The empty mass of the aircraft is the aircraft

- without crew and without removable trim ballast
- without parachute(s)
- without water ballast
- without fuel

but including all of its fixed equipment.

b) Empty mass centre of gravity

It must always be ensured that the empty mass centre of gravity remains within the permitted range. If necessary fixed trim ballast must be installed.

If the empty mass c/g limits and the load limits on the seats are complied with, the centre of gravity in flight will remain within the permitted range.

For empty mass c/g limits see diagram on page 6.4.3.1 and 6.4.3.2.

The empty mass c/g ranges shown in the diagrams on page 6.4.3.1 (powerplant installed) and on page 6.4.3.2 (powerplant removed) are derived from the following seat loads:

Forward c/g limits: With a maximum seat load of 115 kg (253.6 lb) on each seat and with maximum permitted water ballast

Reward c/g limits: With various minimum loads on the front seat (allowance for fuel already made)

6.4 Empty mass and empty mass c/g position (continued)

To facilitate the checking of the empty mass centre of gravity, the table below shows – at different empty mass values – the maximum permissible load on the tail wheel, with various loads on the front seat and in relation to the most rearward c/g position.

The actual load on the tail wheel is determined with the aircraft in weighing attitude, i.e. main wheel on the ground and tail jacked up to flight attitude as described on page 6.2.1.

If the load on the tail wheel is below the value in the table, the empty mass centre of gravity is in front of the rearmost allowed limit for the corresponding minimum cockpit load and empty mass.

There are two different tables depending on the type of tail wheel installed.

a) Table for fixed tail wheel/skid:

Empty mass		Load on fixed tail wheel/skid with a minimum seat load of:									
		70	***154***	**75**	***165***	**80**	***176***	**85**	***187***	**90**	***198***
kg	***lb***	**kg**	***lb***	**kg**	***lb***	**kg**	***lb***	**kg**	***lb***	**kg**	***lb***
450	***992***	48.8	*107.6*	50.5	*111.2*	52.1	*114.9*	53.8	*118.5*	55.4	*122.2*
460	***1014***	49.4	*108.9*	51.0	*112.5*	52.7	*116.2*	54.3	*119.8*	56.0	*123.5*
470	***1036***	50.0	*110.2*	51.6	*113.8*	53.3	*117.5*	54.9	*121.1*	56.6	*124.7*
480	***1058***	50.6	*111.5*	52.2	*115.1*	53.9	*118.7*	55.5	*122.4*	57.2	*126.0*
490	***1080***	51.1	*112.7*	52.8	*116.4*	54.4	*120.0*	56.1	*123.7*	57.7	*127.3*
500	***1102***	51.7	*114.0*	53.4	*117.7*	55.0	*121.3*	56.7	*124.9*	58.3	*128.6*
510	***1124***	52.3	*115.3*	54.0	*119.0*	55.6	*122.6*	57.3	*126.2*	58.9	*129.9*
520	***1146***	52.9	*116.6*	54.5	*120.2*	56.2	*123.9*	57.8	*127.5*	59.5	*131.2*
530	***1168***	53.5	*117.9*	55.1	*121.5*	56.8	*125.2*	58.4	*128.8*	60.1	*132.4*
540	***1190***	54.1	*119.2*	55.7	*122.8*	57.4	*126.4*	59.0	*130.1*	60.7	*133.7*
550	***1213***	54.6	*120.4*	56.3	*124.1*	57.9	*127.7*	59.6	*131.4*	61.2	*135.0*
560	***1235***	55.2	*121.7*	56.9	*125.4*	58.5	*129.0*	60.2	*132.7*	61.8	*136.3*
570	***1257***	55.8	*123.0*	57.4	*126.7*	59.1	*130.3*	60.8	*133.9*	62.4	*137.6*
580	***1279***	56.4	*124.3*	58.0	*127.9*	59.7	*131.6*	61.3	*135.2*	63.0	*138.9*
590	***1301***	57.0	*125.6*	58.6	*129.2*	60.3	*132.9*	61.9	*136.5*	63.6	*140.1*

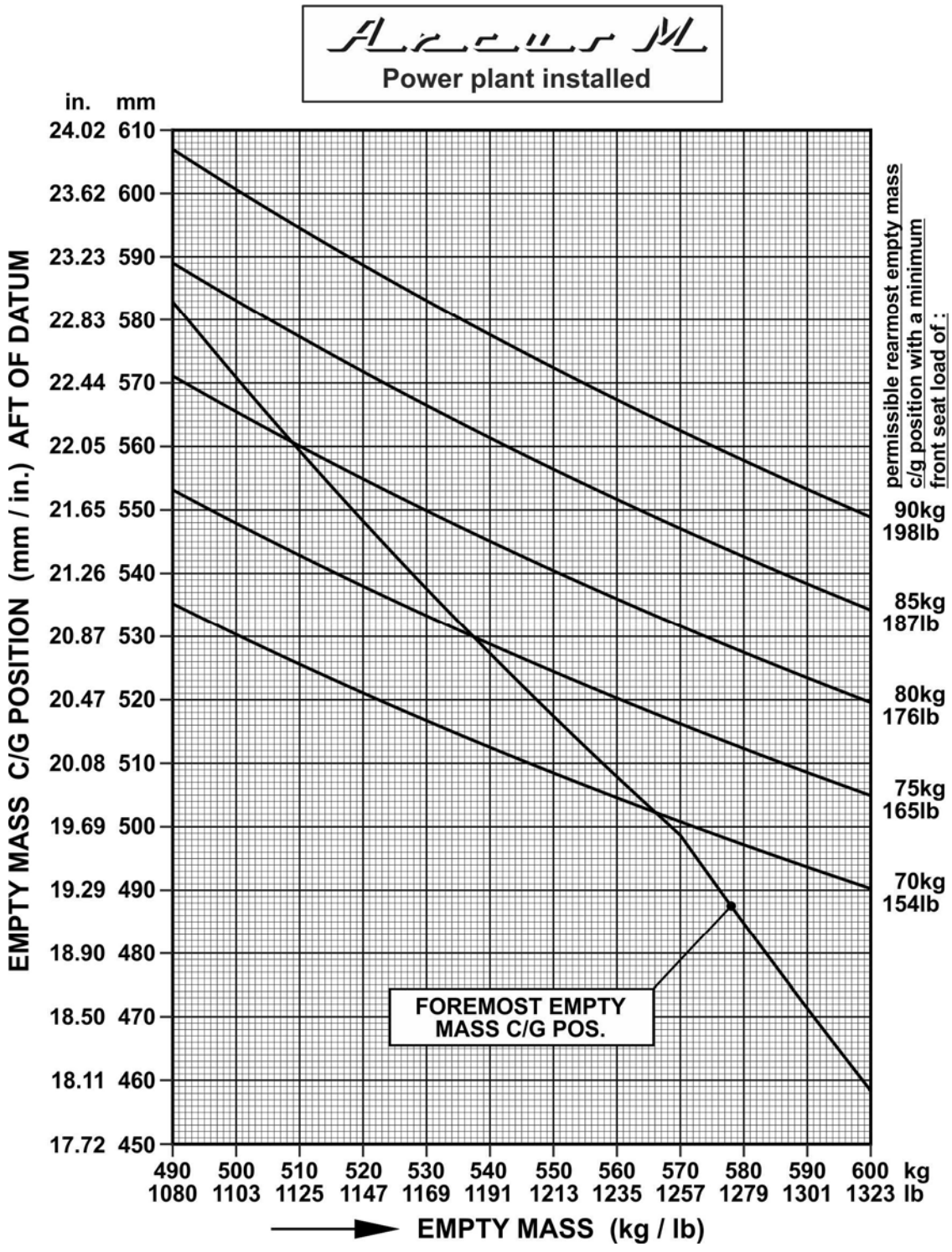
6.4 Empty mass and empty mass c/g position (continued)

b) Table for steerable tail wheel:

Empty mass		Load on steerable tail wheel with a minimum seat load of:									
		70	***154***	**75**	***165***	**80**	***176***	**85**	***187***	**90**	***198***
kg	***lb***	**kg**	***lb***	**kg**	***lb***	**kg**	***lb***	**kg**	***lb***	**kg**	***lb***
450	***992***	46.6	*102.7*	48.2	*106.2*	49.7	*109.6*	51.3	*113.1*	52.9	*116.6*
460	***1014***	47.1	*103.9*	48.7	*107.4*	50.3	*110.9*	51.9	*114.3*	53.4	*117.8*
470	***1036***	47.7	*105.1*	49.3	*108.6*	50.8	*112.1*	52.4	*115.6*	54.0	*119.0*
480	***1058***	48.2	*106.4*	49.8	*109.8*	51.4	*113.3*	53.0	*116.8*	54.5	*120.3*
490	***1080***	48.8	*107.6*	50.4	*111.1*	52.0	*114.5*	53.5	*118.0*	55.1	*121.5*
500	***1102***	49.4	*108.8*	50.9	*112.3*	52.5	*115.8*	54.1	*119.2*	55.7	*122.7*
510	***1124***	49.9	*110.0*	51.5	*113.5*	53.1	*117.0*	54.6	*120.5*	56.2	*123.9*
520	***1146***	50.5	*111.3*	52.0	*114.7*	53.6	*118.2*	55.2	*121.7*	56.8	*125.2*
530	***1168***	51.0	*112.5*	52.6	*116.0*	54.2	*119.4*	55.8	*122.9*	57.3	*126.4*
540	***1190***	51.6	*113.7*	53.2	*117.2*	54.7	*120.7*	56.3	*124.1*	57.9	*127.6*
550	***1213***	52.1	*114.9*	53.7	*118.4*	55.3	*121.9*	56.9	*125.4*	58.4	*128.8*
560	***1235***	52.7	*116.2*	54.3	*119.6*	55.8	*123.1*	57.4	*126.6*	59.0	*130.1*
570	***1257***	53.2	*117.4*	54.8	*120.9*	56.4	*124.3*	58.0	*127.8*	59.6	*131.3*
580	***1279***	53.8	*118.6*	55.4	*122.1*	57.0	*125.6*	58.5	*129.0*	60.1	*132.5*
590	***1301***	54.4	*119.8*	55.9	*123.3*	57.5	*126.8*	59.1	*130.3*	60.7	*133.7*

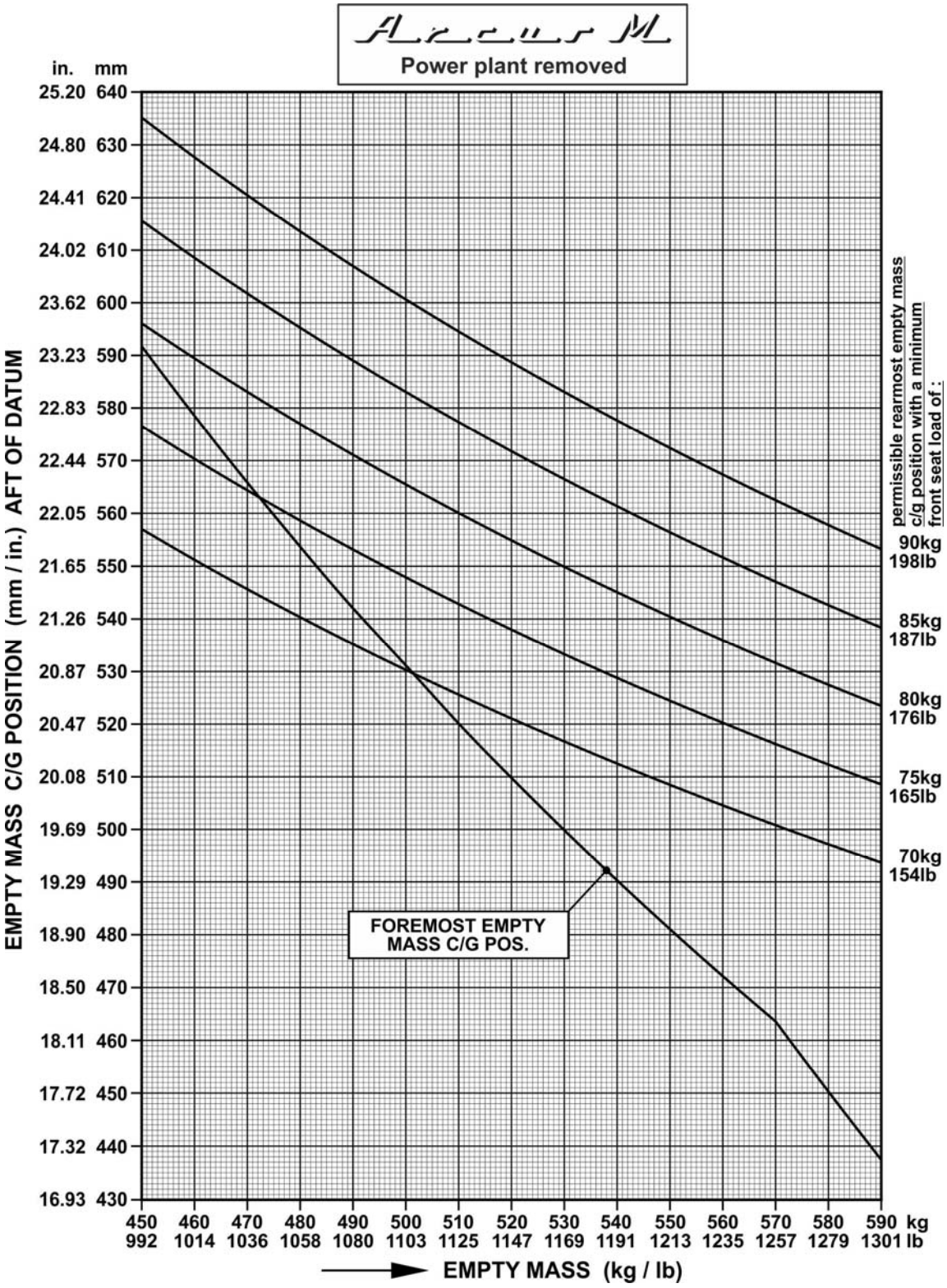
6.4 Empty mass and empty mass c/g position (continued)

Empty mass c/g position (powerplant installed)



6.4 Empty mass and empty mass c/g position (continued)

Empty mass c/g position (powerplant removed)



6.5 Mass of the non lifting parts

The non lifting parts of the aircraft consist of the fuselage including the installed equipment and the payload, rudder and horizontal tailplane.

The maximum permitted mass of the non-lifting parts is

Powerplant installed:	550 kg	(1213 lb)
Powerplant removed:	530 kg	(1169 lb)

See also Flight Manual, page 2.6.

6.6 Payload

Load on the seats

LOAD ON THE SEATS (crew incl. parachutes)				
SEAT LOAD	TWO PERSONS min.	TWO PERSONS max.	ONE PERSON min.	ONE PERSON max.
front seat load	**70*** kg **154*** lb	**115** kg **254** lb	**70*** kg **154*** lb	**115** kg **254** lb
rear seat load	at choice	**115** kg **254** lb	———	———
valid for the following battery location(s):				
1 batt.	engine battery (E)			
2 batt.**	in front of rear stick mounting frame (C1, C2)**			
1 batt.**	in fin (F1)**			
Maximum load in the cockpit when the fuel tank is completely filled ***	**232*** kg / **512*** lb			
The maximum load in the cockpit (load on both seats + baggage + trim ballast) must not be exceeded. If the front seat load is below the minimum front seat load: see instructions in the flight manual - section 6.2.				

Maximum fuel	kg	lb	Ltr.	US. Gal.	IMP. Gal.
	11	24.3	14.5	3.8	3.2

*) Values as an example, the actually applicable values - see Flight Manual loading chart section 6.2 - must be entered.

**) Enter number of batteries installed at weighing and enlisted in equipment list.

***) With removed powerplant the amendment "when fuel tank is completely filled" must be crossed out.

Depending on its equipment and the installation of fixed trim ballast, the actual minimum and/or maximum seat loads of this particular Arcus M (to which this manual refers) may differ from the typical weights listed above.
The placards in the cockpit must always show the actual weights, which are also to be entered in the loading chart – see flight manual, page 6.2.3 or 6.2.4.

Determining the maximum permitted load on the seats:

The **maximum load in the front seat** and the **maximum load in the rear seat** are always 115 kg (253.6 lb).

With powerplant installed:
The **maximum cockpit load with completely filled fuselage fuel tank**, considering 11 kg /24.3 lbs. of fuel, must be set so that the maximum mass of the non-lifting parts and the maximum take off and landing mass are not exceeded (see Flight Manual page 2.6).

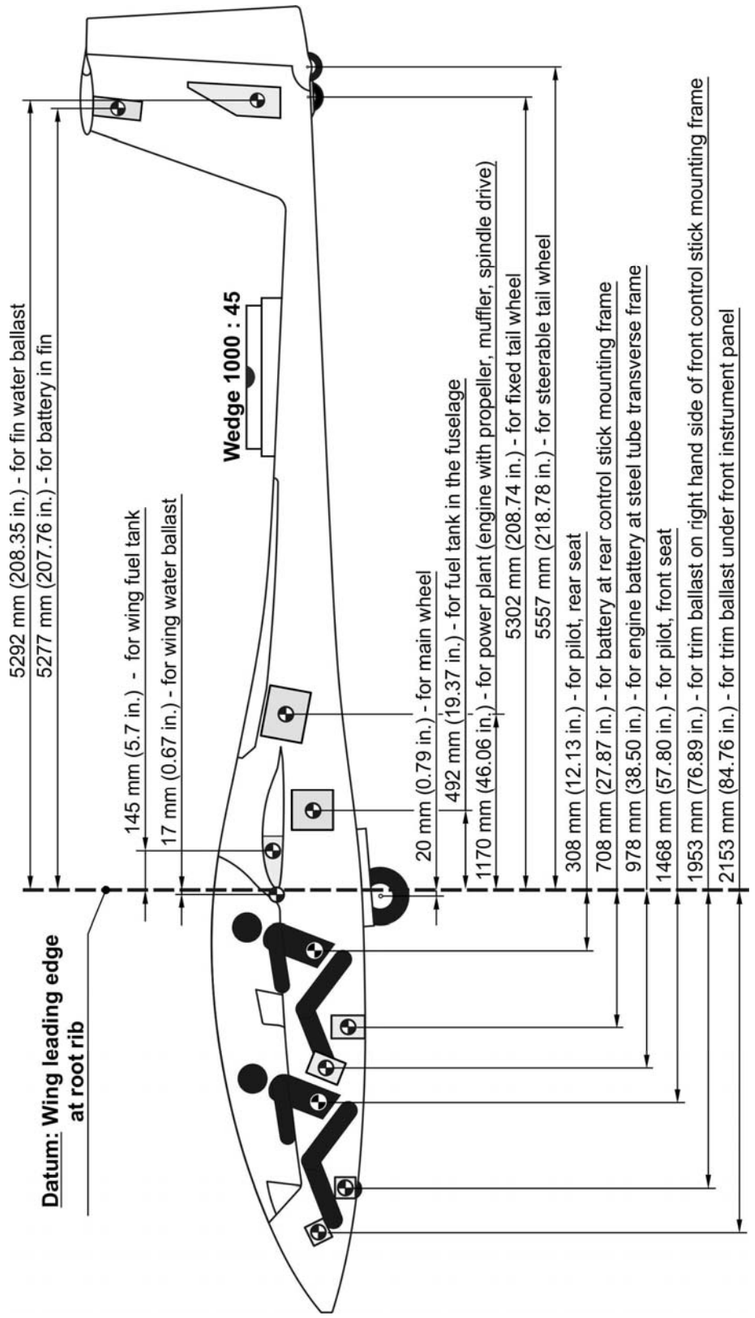
With powerplant removed and empty fuselage fuel tank:
The **maximum cockpit load** must be set in the same way as above but without considering the content of the fuselage fuel tank.

Depending on the circumstances, the maximum cockpit load can be less than 230kg (507 lbs). If this is the case, the maximum load in each seat may not be fully used simultaneously.

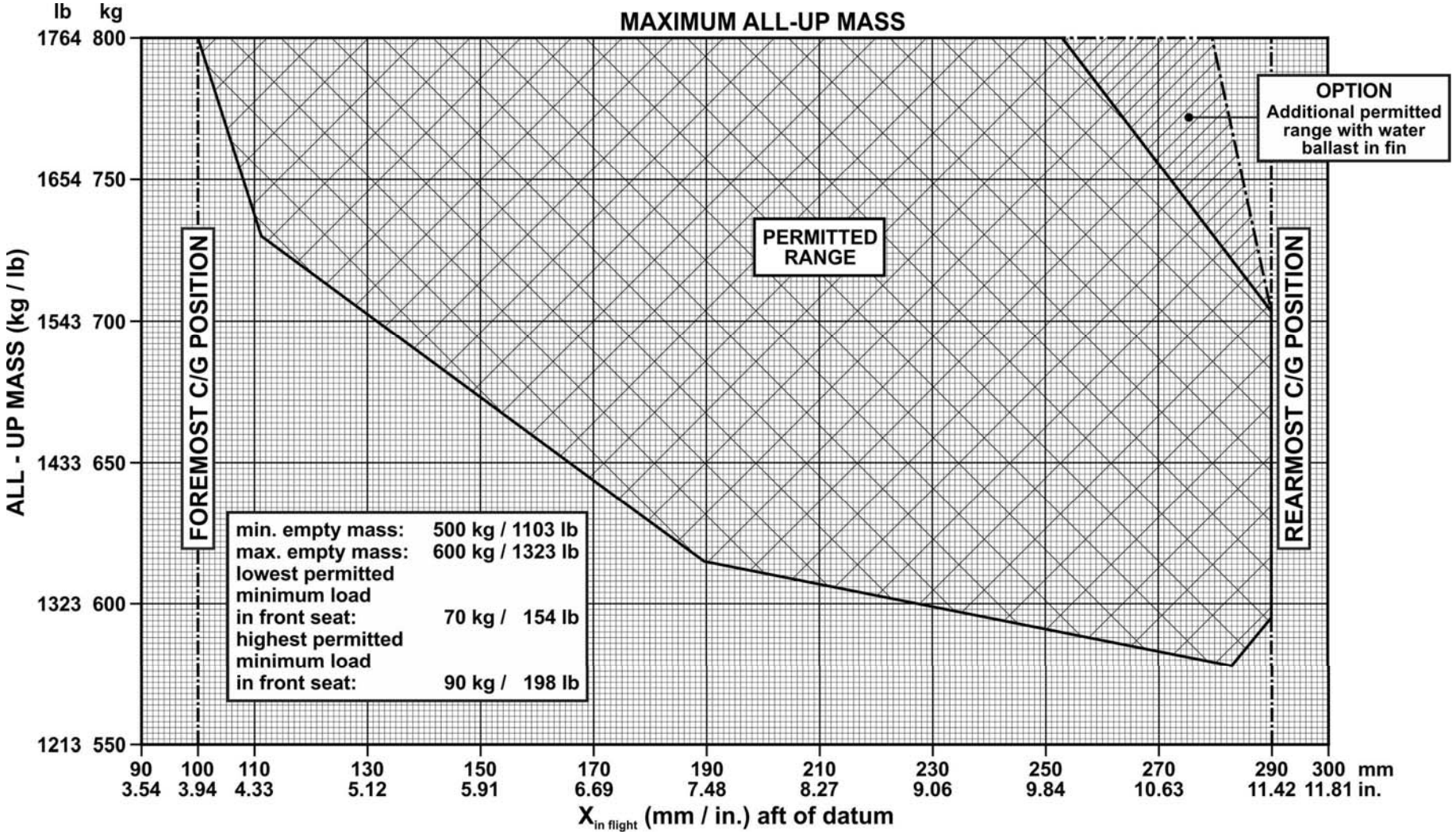
6.6 Payload (continued)

For establishing a „Weight & Balance Report“ the following lever arms are to be used:

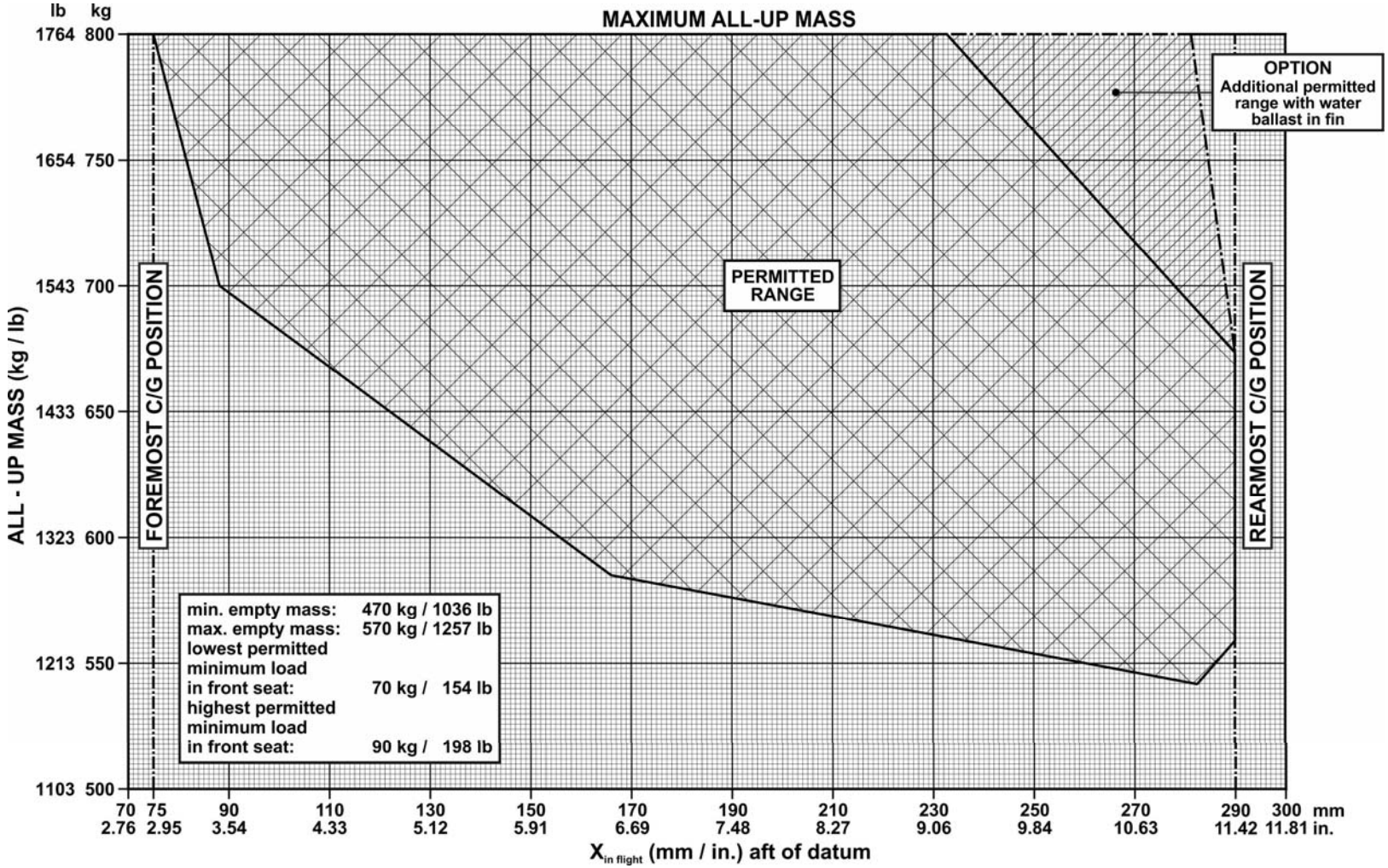
	Center of gravity in relation to datum
Trim ballast under front instrument panel	2153 mm forward of datum 84.76 in.
Trim ballast on right hand side of front control stick mounting frame	1953 mm forward of datum 76.89 in.
Pilot, front seat (with parachute or back cushion)	1468 mm forward of datum 57.80 in.
Engine battery at steel tube transverse frame	978 mm forward of datum 38.50 in.
Battery at rear control stick mounting frame	708 mm forward of datum 27.87 in.
Pilot, rear seat (with parachute or back cushion)	308 mm forward of datum 12.13 in.
Main wheel	20 mm forward of datum 0.79 in
Water ballast, wings	17 mm forward of datum 0.67 in.
Wing fuel tank	145 mm aft of datum 5.7 in
Fuel tank in the fuselage	492 mm aft of datum 19.37 in.
Power plant, retracted (engine with propeller, muffler, spindle drive)	1170 mm aft of datum 46.06 in.
Fixed tail wheel / skid	5302 mm aft of datum 208.74 in.
Steerable tail wheel	5557 mm aft of datum 218.78 in.
Battery fin	5277mm aft of datum 207.76 in.
Water ballast, fin	5292 mm aft of datum 208.35 in.


Wedge 1000 : 45
5292 mm (208.35 in.) - for fin water ballast
5277 mm (207.76 in.) - for battery in fin
145 mm (5.7 in.) - for wing fuel tank
17 mm (0.67 in.) - for wing water ballast
20 mm (0.79 in.) - for main wheel
492 mm (19.37 in.) - for fuel tank in the fuselage
1170 mm (46.06 in.) - for power plant (engine with propeller, muffler, spindle drive)
5302 mm (208.74 in.) - for fixed tail wheel
5557 mm (218.78 in.) - for steerable tail wheel
308 mm (12.13 in.) - for pilot, rear seat
708 mm (27.87 in.) - for battery at rear control stick mounting frame
978 mm (38.50 in.) - for engine battery at steel tube transverse frame
1468 mm (57.80 in.) - for pilot, front seat
1953 mm (76.89 in.) - for trim ballast on right hand side of front control stick mounting frame
2153 mm (84.76 in.) - for trim ballast under front instrument panel
Datum: Wing leading edge at root rib

6.7 Mass – c/g diagram (powerplant installed)


MAXIMUM ALL-UP MASS
lb kg
1764 800
1654 750
1543 700
1433 650
1323 600
1213 550
ALL - UP MASS (kg / lb)
FOREMOST C/G POSITION
REARMOST C/G POSITION
PERMITTED RANGE
OPTION
Additional permitted range with water ballast in fin
min. empty mass: 500 kg / 1103 lb
max. empty mass: 600 kg / 1323 lb
lowest permitted minimum load in front seat: 70 kg / 154 lb
highest permitted minimum load in front seat: 90 kg / 198 lb
90 100 110 130 150 170 190 210 230 250 270 290 300 mm
3.54 3.94 4.33 5.12 5.91 6.69 7.48 8.27 9.06 9.84 10.63 11.42 11.81 in.
X in flight (mm / in.) aft of datum

6.7 Mass – c/g diagram (powerplant removed)


MAXIMUM ALL-UP MASS
lb kg
1764 800
1654 750
1543 700
1433 650
1323 600
1213 550
1103 500
ALL - UP MASS (kg / lb)
OPTION
Additional permitted range with water ballast in fin
PERMITTED RANGE
FOREMOST C/G POSITION
REARMOST C/G POSITION
min. empty mass: 470 kg / 1036 lb
max. empty mass: 570 kg / 1257 lb
lowest permitted minimum load in front seat: 70 kg / 154 lb
highest permitted minimum load in front seat: 90 kg / 198 lb
70 75 90 110 130 150 170 190 210 230 250 270 290 300 mm
2.76 2.95 3.54 4.33 5.12 5.91 6.69 7.48 8.27 9.06 9.84 10.63 11.42 11.81 in.
X in flight (mm / in.) aft of datum

6.8 Operation with powerplant removed

To operate the motorglider as pure sailplane or for maintenance purposes, the powerplant can be removed.
When the powerplant is removed the influence of the powerplant on the empty mass and c/g position must be determined by reweighing. A pure calculation of the c/g position is not precise enough.
After the reinstallation of the complete powerplant it is not necessary to establish a new weighing record if the latest weighing record with the complete powerplant installed is still applicable.

In any case after the conversion the effective data for empty mass and c/g position of the aircraft have to be entered into the loading chart in the Flight Manual (see section 6.2.4 – powerplant removed resp. section 6.2.3 powerplant installed) by an authorized inspector.

The powerplant can be removed as specified in section 5.9 of the maintenance manual. By removing the powerplant (complete propeller pylon including exhaust manifold and spindle drive) the empty weight is reduced by approx. 62 kg (136.7 lb). In order to estimate the effect of the removed powerplant on the empty mass c/g position the following values can be taken into account:

1) With powerplant removed the load on the tail wheel is reduced:

   - with fixed tail wheel / skid by ΔW_2 = approx. -13.9 kg / -30.7 lb
   - with steerable tail wheel by ΔW_2 = approx. -13.3 kg / -29.3 lb

2) This nose-heavy moment can be reduced by removing the not needed battery for the powerplant at the steel tube transverse frame (Hawker Odyssey PC680, 12V/17 Ah, mass approx. 6.8 kg / 15.0 lb).

   Thus the load on the tail wheel is increased:

   - with fixed tail wheel / skid by ΔW_2 = approx. 1.22 kg / 2.70 lb
   - with steerable tail wheel by ΔW_2 = approx. 1.17 kg / 2.58 lb

3) The remaining nose-heavy moment due to the removed powerplant and the removed engine battery can be compensated further with the following actions:

   1. Removal of one Avionic-battery in front of the rear control stick mounting frame (if a second Avionic-battery is installed).
   2. Installation of a correspondingly shaped trim weight for the top of the vertical tail (approx. 1.6 to 1.8 kg / 3.53 to 3.97 lb)
   3. Installation of tail wheel with brass hub (add. mass approx. 2.5 kg / 5.5 lb).

With this information the new empty mass c/g position and the load on the seats can be estimated.

6.9 Operation with nose skid (optional)

The motorglider Arcus M can be operated with a nose skid instead of a nose wheel.

When operating with the nose skid instead of the nose wheel, the minimum cockpit load in the front seat increases by 2 kg (4.4 lb).

With nose skid:
Minimum cockpit load increases by 2 kg (4.4 lb).

The placard shown above shall be placed in the cockpit near the cockpit load placards, see also Flight Manual page 2.15.

7. List of approved equipment

7.1 Safety belts

Two four-piece symmetrical safety harnesses are required.

The following restraint system may be used:

Lap belts

Type	Manufacturer	Data-Sheet No.
Bagu 5202	Gadringer	40.070/32
4-01-1256	Schroth	40.073/11

Shoulder straps

Type	Manufacturer	Data-Sheet No.
Schugu 2700	Gadringer	40.071/05
4-01-1256	Schroth	40.073/11

7.2 Instruments and equipment

The following instruments are available for the minimum equipment of the Arcus M (see also section 2.12 of the Flight Manual):

a) Minimum equipment

AIRSPEED INDICATOR (minimum range: 50 to 300 km/h, 27–162 kts, 31–186 mph)
Manufacturer: Gebr. Winter, Jungingen

Model	Code No.	Data-Sheet No.
6 FMS 4 7 FMS 4 6 FMS 5 7 FMS 5	6421 7421 6511 7511	TS 10.210/15 TS 10.210/19 TS 10.210/16 TS 10.210/20

ALTIMETER
Manufacturer: Gebr. Winter, Jungingen

Model	Code No.	Data-Sheet No.
4 HM 6	4060 (m) 4200 (ft)	TS 10.220/44
4 FGH 10	4110 (m) 4320 (ft)	TS 10.220/46
4 FGH 20	4220 (m) 4440 (ft)	TS 10.220/47
4 FGH 40	4550 (ft)	TS 10.220/48
or other altimeter certified according to TSO C 10 b		

OUTSIDE AIR TEMPERATURE (OAT) INDICATOR (when flying with water ballast)

Model	Manufacturer	Specif.-No.
Temperature gauge TF 00-59K	Störk	01 59 042
Remote temperature probe Y-LE-TNF /-20 +60	Kobold	01 59 042

MAGNETIC COMPASS

Model	Manufacturer	Data-Sheet No.
FK 16	Ludolph	L-10.410/3
C 2300	Airpath	---
C 2400	Airpath	---

7.2 Instruments and equipment (continued)

a) Minimum equipment (continued)

POWERPLANT CONTROL SYSTEM
with integrated tachometer and fuel gauge

Model	Manufacturer	Specif.-No.
Powerplant operating unit MCU II BG	ILEC GmbH Bayreuth	MCU II
Powerplant control unit MCU II SG		

b) Additional Equipment

VARIOMETER
Manufacturer: Gebr. Winter, Jungingen

Model	Code No.	Data-Sheet No.
5 St VL 5 St VLM 5 St V 5 St VM	all code numbers approved	TS 10.230/11 TS 10.230/12 TS 10.230/13 TS 10.230/14

TURN & BANK INDICATOR with slip ball

Model	Manufacturer	Data-Sheet No.
WZ 402/31	Apparatebau Gauting	10-241/8
IFR 51-12-2	Instruments and Flight Research, Wichita/USA	TSO C 3 b

OXYGEN SYSTEM

Model	Manufacturer	Code-No.	Data-Sheet No.
Höhenatmer HLa 758	Dräger	E 20088	40.110/1
Miniregler	Dräger	E 24902	40.110/19
Miniregler	Dräger	E 24903	40.110/19

7.2 Instruments and equipment (continued)

b) Additional Equipment (continued)

VHF-TRANSCEIVERS

Model	Manufacturer	Data-Sheet No.
FSG 40 S	W. Dittel GmbH.	10.911/45
FSG 50	W. Dittel GmbH.	10.911/71
FSG 60	W. Dittel GmbH.	10.911/72
FSG 70	W. Dittel GmbH.	10.911/81
FSG 71 M	W. Dittel GmbH.	10.911/81
FSG 90, 90H1	W. Dittel GmbH.	10.911/98JTS
FSG 2T	W. Dittel GmbH.	10.911/103JTSO
ATR 720	Avionic Dittel	10.911/70
ATR 720 A	Filser Electronic GmbH.	10.911/74
ATR 720 B	Filser Electronic GmbH.	10.911/80
ATR 720 C	Filser Electronic GmbH.	10.911/83
ATR 500	Filser Electronic GmbH.	O.10.911/113JTSO
ATR 600	Filser Electronic GmbH.	O.10.911/106JTSO
ATR 600R01	Filser Electronic GmbH.	O.10.911/115JTSO
ATR 833	Filser Electronic GmbH.	EASA.21O.0193
M760	Microair	CAA LA301068
AR 3201	Becker	10.911/76
AR 3201-( )	Becker	10.911/76
AR 4201	Becker	10.911/87
AR 6201	Becker	EASA.21O.1249
or other VHF-Transceivers, certified according to TSO, JTSO or ETSO for the use in airplanes		

EMERGENCY LOCATOR TRANSMITTER

Model	Manufacturer	Data-Sheet No.
EB-2 B (CD)	Mar Tech Division	10.915/2
ELT 10	Narco Avionics	10.915/3
ELT 8.1	Dorne & Margolin Inc.	10.915/5
3000	Pointer	10.915/6
ACK E01	ACK Technologies Inc.	10.915/9
ACK E04	ACK Technologies Inc.	EASA.IM.21O.10028407
ME 406 ELT	Artex Aircraft Supplies Inc.	EASA.IM.21O.416
AK-451-() ELT	Ameri-King Corporation	EASA.IM.21O.1102

7.2 Instruments and equipment (continued)

b) Additional Equipment (continued)

TRANSPONDER MODE A/C

Model	Manufacturer	Data-Sheet No.
ATC 2000-(3)-R(XX) (ATC 3401-1-R, CU 3400-1-(XX), CU 5401-1-(XXX))	Becker	LBA.0.10.930/54 JTSO
ATC 4401 (ATC4401-1-175, ATC4401-2-175, ATC441-1-250, ATC4401-2-250)	Becker	LBA.0.10.930/062 JTSO
T2000	Microair	LBA.10.930/066 JTSO
ACK A-30	ACK Technologies	TSO C-88a
or other Transponder, certified according to TSO, JTSO or ETSO for the use in airplanes		

TRANSPONDER MODE S

Model	Manufacturer	Data-Sheet No.
BXP 6401-1-(01)+ BXP 6402-1R-(01) BXP 6401-2-(01)+ BXP 6402-2R-(01) AM 6400-1-(01) Address modul CU 6401-1-(01) Control unit	Becker	EASA.21O.322
BE 6 400-01-(01) Blind Encoder	Becker	EASA.21O.001174
ACK A-30	ACK Technologies	TSO C-88a
TRT 600 TRT 800 TRT-800H	Filser	10.930/063 NTS EASA.21O.045 EASA.21O.269
VT-0101 VT-0102-070 VT-01 VT-0102-125 VT-0103-1 VT-01 Ultra Compact Rev. A	Garrecht	EASA.21O.384
or other Transponder, certified according to TSO, JTSO or ETSO for the use in airplanes		

7.2 Instruments and equipment (continued)

Note for the installation of additional equipment*:

Additional equipment as listed under 7.2 b) and further additional equipment that is not mentioned under 7.2 b)* can be installed under the following requirements:

- It must be ensured that the equipment in itself or its effect upon the airplane does not constitute a hazard to safe operation.

- It must be ensured that the equipment is safely fixed under all operating conditions and does not constrain the operation of the airplane. Furthermore, it must be ensured that the equipment does not cause a hazard in a crash.

- The mass of the equipped instrument panel must not exceed the allowed maximum mass. If no allowed maximum mass is mentioned in the flight- or maintenance manual, the maximum weight of the equipped instrument panel is limited to 10 kg / 22 lb.

- The electric installation of the additional equipment has to conform to the information given in the maintenance manual and the wiring diagram in the flight manual.

- The instructions of the manufacturer of the particular equipment for the installation must be followed.

- The equipment list of the affected airplane has to be updated and if necessary a new weight and balance report has to be provided.

- The measures taken and their inspections have to be conducted in compliance with the applicable national rules.

- Documents associated with the equipment provided by its manufacturer or, if applicable, by the supplier should be included in the documentation of the airplane.

***** such as variometer, final glide computer, flight logger, navigation computer, turn point camera, TEK-Probes, bug wipers etc.

7.2 Instruments and equipment (continued)

Electrical power supply

For the electrical power supply the following battery-types might be used:

a) For the power supply of the powerplant system and optionally also the Avionc (see diagram 10, Position 1) the following battery-types might be used:

- Sealed Lead-Acid-Battery Hawker Odyssey PC 680 (12V, 17Ah)
  or similar type with at least 16 Ah capacity and the applicable housing dimensions.

b) As optional batteries which are only used as power supply for the Avionic (see diagram 9, position 2a to 2c) the following battery-types might be used:

- Sealed Lead-Acid-Battery Panasonic LC-R127R2PG 12V 7.2 Ah
  resp. LC-RA1212PG1 12V 12 Ah
  or similar type with at least 5.7 Ah capacity and applicable housing conditions.

- Lithium-Iron-Phosphate-Battery Airbatt Energiepower LiFePO4 12V 8 Ah
  resp. LiFePO4 12V 15 Ah
  or similar type with at least 5.7 Ah capacity and applicable housing conditions.

- Nickel-Metal Hydride-Battery Airbatt NIMH 12V 14AH G
  or similar type with at least 5.7 Ah capacity and applicable housing conditions.

If solar panels are installed (optional, see diagram 9) only lead-acid batteries or lithium-iron-phosphate batteries are to be used.

8. Placards and pictograms

Placing:

IDENTIFICATION PLATE
(fire resistant)

Variant 1

Hersteller:
SCHEMPP-HIRTH
Flugzeugbau GmbH

Baumuster:	**Arcus M**
Werk-Nr./Bj:	**/**
Geräte-Nr.:	**EASA.A.532**

Variant 2

Hersteller:
SCHEMPP-HIRTH
Flugzeugbau GmbH

Baureihe: (Variant)	**Arcus M**
Werk-Nr. / Bj: (Ser.no / Mfrd.)	
Geräte-Nr.: (TCDS)	**EASA.A.532**

Cockpit inner skin on the right in the rear

OPERATING LIMITS

Cockpit inner skin on the left for both seats

PERMITTED ALL-UP MASS:	800 kg / 1764 lb		
MAXIMUM PERMITTED SPEEDS (IAS):	**km/h**	**kt**	**mph**
Flap setting **0, -1, -2, S**	**280**	**151**	**174**
Flap setting **+2, +1, L**	**180**	**97**	**112**
Rough air speed	**180**	**97**	**112**
Maneuvering speed	**180**	**97**	**112**
Aerotowing speed	**180**	**97**	**112**
Winch launching speed	**150**	**81**	**93**
Landing gear operating speed	**180**	**97**	**112**
For power plant extension/retraction	**120**	**65**	**74**
Power plant extended speed	**180**	**97**	**112**
PERMISSIBLE MINIMUM SPEED (IAS):			
For power plant extension/retraction	**90**	**49**	**56**

Max. permitted speed			
Altitude [m]	V_{NE} (IAS) km/h	kt	mph
0	**280**	**151**	**174**
1000	**280**	**151**	**174**
2000	**280**	**151**	**174**
3000	**280**	**151**	**174**
4000	**263**	**142**	**163**
5000	**245**	**132**	**152**
6000	**232**	**125**	**144**
7000	**220**	**119**	**137**
8000	**207**	**112**	**129**
9000	**195**	**105**	**121**
10000	**182**	**98**	**113**

OPERATING LIMITS

Cockpit inner skin on the left in the rear

WEAK LINK FOR TOWING	
for Aerotow:	**max. 850 daN (1910 lb)**
for Winch launch:	**max. 1000 daN (2248 lb)**
TIRE PRESSURE	
Nose wheel:	**3.0 bar (43 psi)**
Main wheel:	**4.0 bar (57 psi)**
Tail wheel:	**3.0 bar (43 psi)**

A E R O B A T I C S

ONLY WITHOUT WATER BALLAST IN THE WINGS, UP TO AN ALL-UP MASS OF 690 kg (1521 lb), WITH RETRACTED OR REMOVED POWER PLANT AND WITH FLAP POSITION "0" THE FOLLOWING AEROBATIC MANEUVERS ARE PERMITTED:

(A) Inside loops
(B) Stalled turns
(C) Lazy eight
(D) Spins

Operating Conditions: See Flight Manual

Cockpit inner skin on the right for both seats

Placing:

LOAD ON THE SEATS (crew incl. parachutes)				
SEAT LOAD	TWO PERSONS min.	TWO PERSONS max.	ONE PERSON min.	ONE PERSON max.
front seat load	**70*** kg **154*** lb	**115** kg **254** lb	**70*** kg **154*** lb	**115** kg **254** lb
rear seat load	at choice	**115** kg **254** lb	———	———

OPERATING LIMITS

Cockpit inner skin on the right for both seats

valid for the following battery location(s):	
1 batt.	engine battery (E)
2 batt.**	in front of rear stick mounting frame (C1, C2)**
1 batt.**	in fin (F1)**

Maximum load in the cockpit when the fuel tank is completely filled ***	**232*** kg **/ 512*** lb

The maximum load in the cockpit (load on both seats + baggage + trim ballast) must not be exceeded.
If the front seat load is below the minimum front seat load: see instructions in the flight manual - section 6.2.

Maximum fuel	kg	lb	Ltr.	US. Gal.	IMP. Gal.
	11	**24.3**	**14.5**	**3.8**	**3.2**

***)** Values as an example, the actually applicable values - see Flight Manual loading chart section 6.2 - must be entered.

****)** Enter number of batteries installed at weighing and enlisted in equipment list.

*****)** With removed powerplant the amendment "when fuel tank is completely filled" must be crossed out.

WHEN FLOWN SOLO, THE PLACARDED MINIMUM FRONT SEAT LOAD MAY BE REDUCED BY UP TO:	NUMBER OF LEAD PLATES REQUIRED
- 05 kg (11 lb)	**1**
- 10 kg (22 lb)	**2**
- 15 kg (33 lb)	**3**

(if installed)

Cockpit inner skin on the right (front seat only)

BAGGAGE COMPARTMENT

Max. load: 2.0 kg (4.4 lb)

Cockpit inner skin on the right in the rear

Placing:

CHECK LIST BEFORE TAKE-OFF

- **O** Water ballast in fin tank correctly filled (if installed) ?
  Dump all water ballast in case of doubt !
- **O** Loading chart checked ?
- **O** Parachute securely fastened ?
- **O** Safety harness secured and tight ?
- **O** Seat back, head rest and pedals in comfortable position ?
- **O** All controls and instruments easily accessible ?
- **O** Airbrakes checked and locked ?
- **O** All control surfaces checked with assistant for full and free movement in correct sense ?
- **O** Trim correctly set ?
- **O** Flaps set for take-off ?
- **O** Canopy closed and locked ?

CHECK LIST FOR SELF-LAUNCHING

- **O** Fuel quantity checked ?
- **O** Warning messages of operating unit ?
- **O** Coolant liquid temperature checked ?
- **O** Ignition circuits checked ?
- **O** Redundancy system engine control checked ?
- **O** Take-off RPM checked ?
- **O** Rear-view mirror properly adjusted ?

Cockpit inner skin on the right for both seats

POWERPLANT EXTENSION / STARTING PROCEDURE

- **O** Power plant master switch **ON**
- **O** **OPEN** fuel shut-off valve
- **O** Set throttle to idle
- **O** Set speed to **95-100 km/h (51-54kt, 59-62 mph)**
- **O** Ignition **ON**
- **O** *Only in manual operation:* ***EXTEND*** *powerplant*
- **O** When powerplant is fully extended (green signal): Depress starter button

ON THE GROUND:

- **O** Apply wheel brake, pull stick back
- **O** Check that propeller is clear

STOPPING ENGINE / RETRACTING POWERPLANT

- **O** Reduce speed to about **95-100 km/h (51-54 kt, 59-62 mph)**
- **O** Cooling down power setting 20% (1 minute)
- **O** Ignition **OFF**
- **O** *Only in manual operation:*
  - *Stop propeller with the manually operated propeller brake and fix it in the vertical position*
  - ***RETRACT*** *powerplant*
- **O** When powerplant is fully retracted (green signal): Power plantmaster switch **OFF**

Cockpit inner skin on the left
- for front seat only (unless a 2nd control unit is installed)

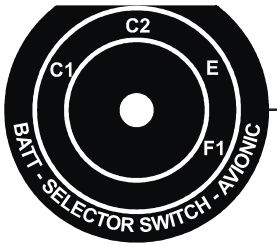
Placing:

Instrument		Normal Range	Caution Range	Maximum Limit
TACHOMETER (RPM INDICATOR) (min $^{-1}$)	Signal	green	yellow	red flashing
	Range	2500 - 6600	6600 - 6700	6700 5 min > 6600
COOLANT LIQUID TEMPERATURE (°C)	Signal	—	—	—
	Range	25 - 115	—	115 value flashing
FUEL QUANTITY INDICATOR (Liter)	Signal	—	yellow	—
	Range	- 6	> 6 - 0	—
		Tank in fuselage and wing(s)	Fuselage tank only	

Operating limits — Cockpit inner skin on the left - for front seat only (unless a 2nd control unit is installed)

WITH NOSE SKID:
Minimum load increases by 2 kg / 4.4 lb!

Change of minimum load (optional) — Next to loading chart
Front and rear cockpit



Battery selector switch (OPTION)
E - Engine battery
C1 - Batt. in front of rear seat on the left
C2 - Batt. in front of rear seat on the right
F1 - Batt. in fin

Front instrument panel

T.E.

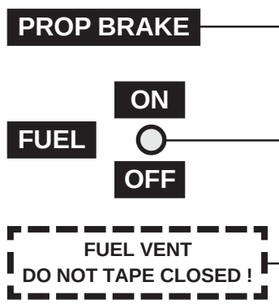
STAT

Pneumatic switch for TE-compensation probe (optional) — Front instrument panel

PC-Interface engine control (Trijekt)

PC-Interface engine control (Trijekt) — on rear back cover right

Placing:



Manual propeller brake

Front and rear seat on manual propeller brake handle

Electrical refueling system

Bulkhead behind rear seat on the left, next to ON/OFF switch

Fuel vent

Right side behind landing gear cut-out

AVGAS 100 LL OR UNLEADED PREMIUM GASOLINE - EN 228 (MIN. RON 95)
GASOLINE/OIL MIXING PROPORTION 1:50
with TWO-STROKE OIL: CASTROL ACT>EVO, CASTROL SUPER TWO-STROKE or alternative oils according to JASO FC or FD

	TANK IN FUSELAGE			TANK IN RIGHT INBD. WING (optional)			TANK IN LEFT INBD. WING (optional)			TOTAL CAPACITY		
	Liter	U.S.Gal.	IMP.Gal.	Liter	U.S.Gal.	IMP.Gal.	Liter	U.S.Gal.	IMP.Gal.	Liter	U.S.Gal.	IMP.Gal.
CAPACITY OF	14.5	3.80	3.20	-	-	-	-	-	-	14.5	3.80	3.20
	14.5	3.80	3.20	13.0	3.43	2.86	-	-	-	27.5	7.23	6.06
	14.5	3.80	3.20	13.0	3.43	2.86	13.0	3.43	2.86	40.5	10.60	9.00
USABLE FUEL	14.0	3.70	3.10	-	-	-	-	-	-	14.0	3.70	3.10
	14.0	3.70	3.10	12.5	3.30	2.75	-	-	-	26.5	7.00	5.85
	14.0	3.70	3.10	12.5	3.30	2.75	12.5	3.30	2.75	39.0	10.30	8.50

FUSELAGE TANK IS FILLED UP VIA WING TANKS

Tank label

Label on cockpit inner skin on the right in the rear and next to ON/OFF switch of electrical refueling system

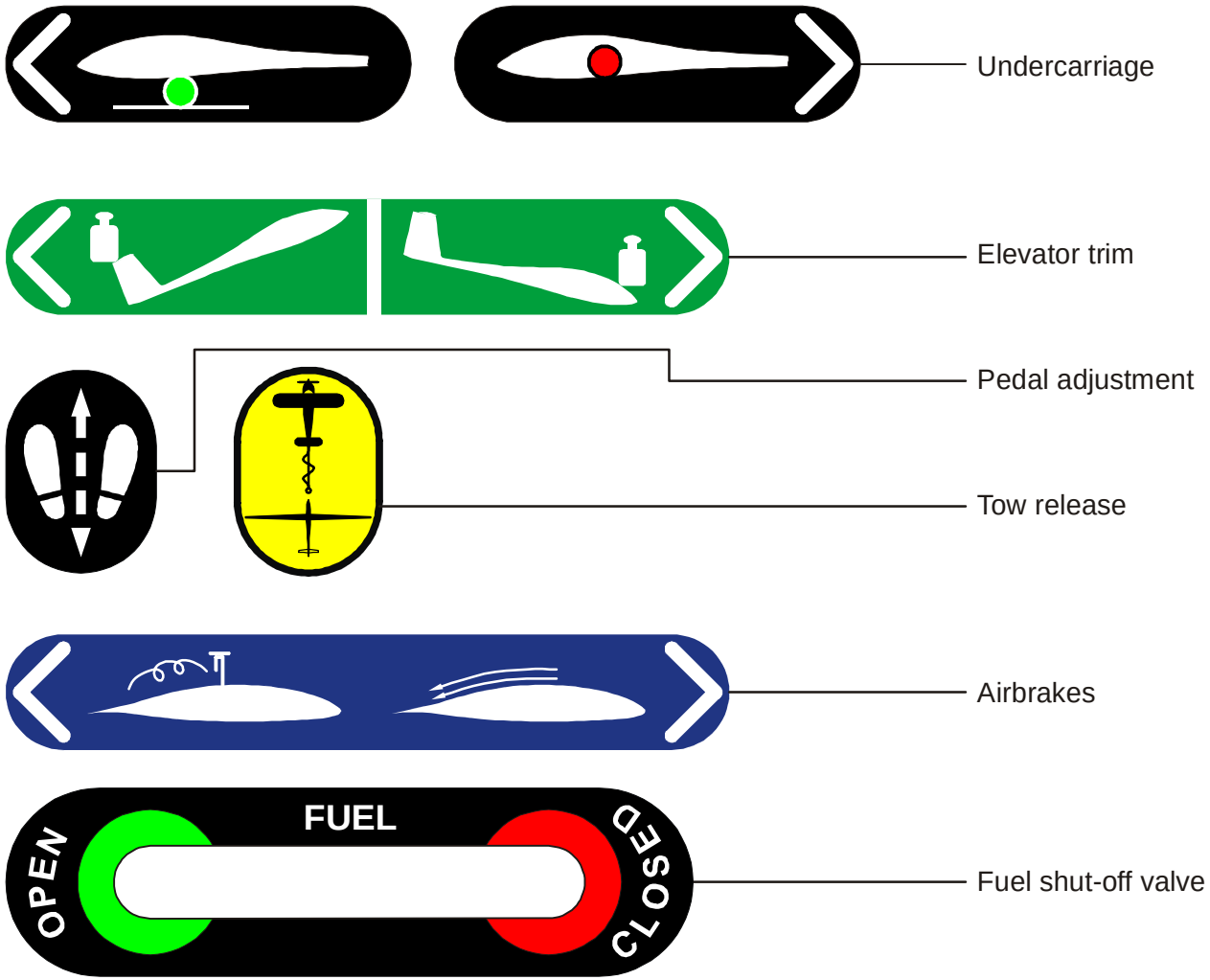
Use of flaps for	flaps at	OPTIMUM AIRSPEED in km/h	
		AUW = 625 kg	AUW = 800 kg
Low speed flight	L	- 83 km/h	- 94 km/h
	+2	83 - 90 km/h	94 - 100 km/h
	+1	90 - 105 km/h	100 - 120 km/h
Best L/D	0	105 - 130 km/h	120 - 150 km/h
Flying between thermals and high speed flying	-1	130 - 155 km/h	150 - 180 km/h
	-2	155 - 175 km/h	180 - 195 km/h
	S	175 - 280 km/h	195 - 280 km/h

Use of flaps for	flaps at	OPTIMUM AIRSPEED in knots	
		AUW=625 kg/1378 lb	AUW=800 kg/1764 lb
Low speed flight	L	- 45 kt	- 51 kt
	+2	45 - 49 kt	51 - 54 kt
	+1	49 - 57 kt	54 - 65 kt
Best L/D	0	57 - 70 kt	65 - 81 kt
Flying between thermals and high speed flying	-1	70 - 84 kt	81 - 97 kt
	-2	84 - 94 kt	97 - 105 kt
	S	94 - 151 kt	105 - 151 kt

Use of flaps for	flaps at	OPTIMUM AIRSPEED in mph	
		AUW=625 kg/1378 lb	AUW=800 kg/1764 lb
Low speed flight	L	- 52 mph	- 58 mph
	+2	52 - 56 mph	58 - 62 mph
	+1	56 - 65 mph	62 - 75 mph
Best L/D	0	65 - 81 mph	75 - 93 mph
Flying between thermals and high speed flying	-1	81 - 96 mph	93 - 112 mph
	-2	96 - 109 mph	112 - 121 mph
	S	109 - 174 mph	121 - 174 mph

Optimum airspeeds (for various flap settings)

Cockpit inner skin on the left for either seat



Placing:

Above guide slot for operating handle on the right for both seats

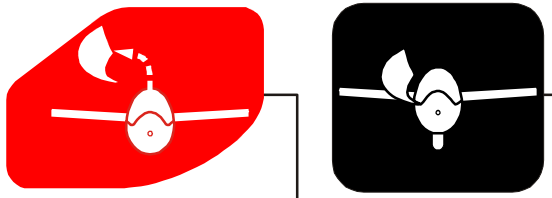
Next to guide slot in seat pan mounting flange on the left for both seats

Front seat: At the base of the control stick on the right
Rear seat: Next to the pedal locking ring

Front seat: At the base of the control stick on the left
Rear seat: On the left of the instrument panel

Next to operating handle on cockpit inner skin on the left for both seats

Above guide slot on cockpit inner skin on the right for both seats



Canopy locking mechanism black

Below red locking lever on cockpit inner skin on the left for both seats

Canopy locking mechanism red

On red locking lever on the left for both seats

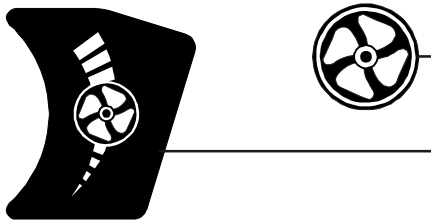
Canopy attachment/ detachment

Next to operating handle on cockpit inner skin on the right for both seats

(if installed)

Operating knob for dumping ballast from wing tanks

Front seat above guide slot for operating knob on cockpit inner skin on the right



Ventilation

At the operating knob protruding from front instrument panel

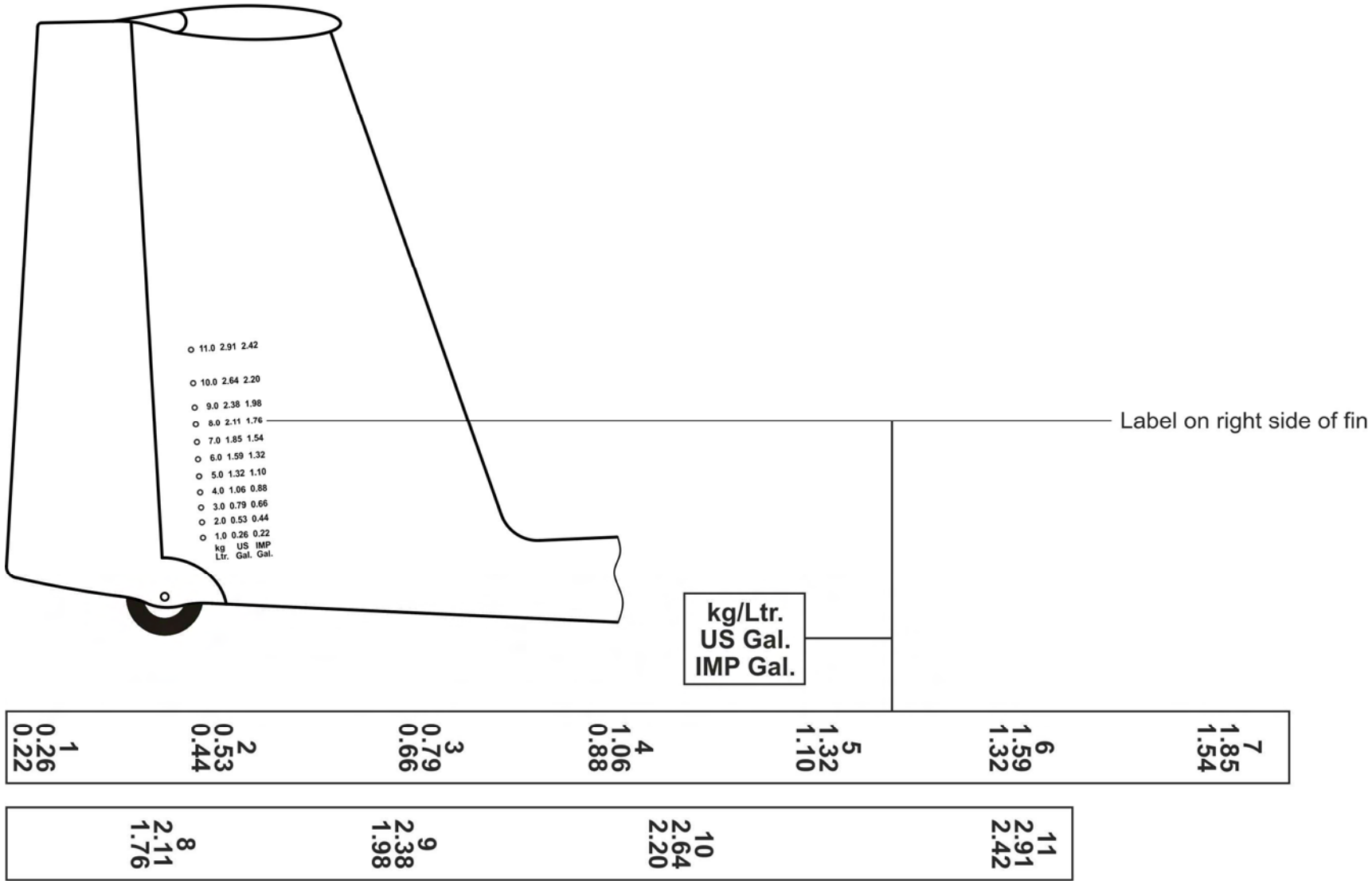
Ventilation adjustment

Beside adjustable bull-eye-type ventilator on the right for both seats

Flap settings

Front and rear seat along notched plate

Placing:


11.0 2.91 2.42
10.0 2.64 2.20
9.0 2.38 1.98
8.0 2.11 1.76
7.0 1.85 1.54
6.0 1.59 1.32
5.0 1.32 1.10
4.0 1.06 0.88
3.0 0.79 0.66
2.0 0.53 0.44
1.0 0.26 0.22
kg Ltr. US Gal. IMP Gal.
Label on right side of fin
kg/Ltr.
US Gal.
IMP Gal.
1 0.26 0.22
2 0.53 0.44
3 0.79 0.66
4 1.06 0.88
5 1.32 1.10
6 1.59 1.32
7 1.85 1.54
8 2.11 1.76
9 2.38 1.98
10 2.64 2.20
11 2.91 2.42

9. Maintenance instructions

a) Airframe
"Repair Instructions for Arcus M", valid issue as appropriate

b) Tow releases
1. Operating Manual for the TOST nose tow release mechanism model „E 85", Issue of March 1989, LBA-approved
2. Operating Manual for the TOST safety tow release mechanism model „EUROPA G 88", Issue of February 1989, LBA-approved

c) Engine
1. Operating Manual for the SOLO engine type 2625-02i, valid issue as appropriate
2. Maintenance Manual for the SOLO engine type 2625-02i, valid issue as appropriate

d) Propellers (Manufacturer "Technoflug" or "Binder")
Operating and Maintenance Manual No. P3 for Fixed Pitch Two-Blade Composite Propeller KS 1G ()()(), KS 1 C ()()(), latest approved issue
or
Use and maintenance instructions for fixed propeller made of fibre composite, Propeller type BM, issue 21. October 2007 or later approved revision

e) Wing fuel tank(s) (if installed)
"Instructions for the Inspection of the Flexible Fuel Tanks Typ HFK-TLF", latest applicable issue

f) Diluter demand oxygen system (if installed)
1. Operating Instructions No. 1/601 for DRÄGER regulator model „HLa 758"
2. Installation Instructions for DRÄGER high altitude diluter demand oxygen system and Maintenance and Operating Proposals, 2nd Edition of June 1978

g) VHF-Transceivers
Maintenance Instructions for the models listed in section 7.2

h) For further equipment installed refer to the „Instructions to the Operator" issued by the manufacturer of the relevant instrument, especially for equipment listed in section 7.

Note:
Further information for the maintenance of the powered sailplane are provided in sections 1.4, 1.5, 4.2, and 7 of the Flight Manual.

10. Logging of service time and take-offs

a) Airframe

The time in service of this aircraft and any take-offs are to be entered in its log book.

b) Engine

The time in service of the engine of this aircraft can be read from the powerplant operating unit and are to be entered in the aircrafts log book.

11. List of special tools

Rigging and derigging of the aircraft

Application	Description	Art.-No.
Rigging and derigging of horizontal tail	Mounting bolt for horizontal tail (ZRB 177)	B40-0708
Rigging and derigging of inner wing panels	Mounting tool, variant „Duo Discus“ (ZFB 107)	B40-1540
Rigging and derigging of outer wing panels	Mounting aid (ZRB 155)	B40-0749

Powerplant maintenance

Application	Description	Art.-No.
Tensioning of V-belts (s. MM section 5.12)	Belt adjusting disc Bolt M14x60-DIN 931-8.8 vz Nut M14-8 DIN 934-8 vz	B40-3329 L01-1292 L01-1293
Removal of small pulley with starter ring gear from crankshaft	Pull off device, driving side *)	
	Part 1: Pull off device, drive side	SOLO 00 80 585
	Part 2: Screw M12x50	SOLO 00 10 140
	Part 3: ram	SOLO 00 80 588
Removal of ignition system rotor from crankshaft on the rear side of the engine	Pull off device, ignition side*)	
	Part 1: Pull off device Ducati	SOLO 00 80 530
	Part 2: Screw M12x50	SOLO 00 10 140
	Part 3: Screw M8x40 (3 Stk.)	SOLO 00 10 150
Determination of drive belt tension with use of a frequency meter	Frequency meter	SOLO 23 00 909
Determination of drive belt tension by deformation measurement	Device for measuring drive belt tension	B40-3338

*) Designated parts originate from the accessories list of the engine manufacturer and are supplied with the aircraft (see „Parts catalogue aircraft engine SOLO 2625-02i” from the engine manufacturer)

12. Spare-parts list

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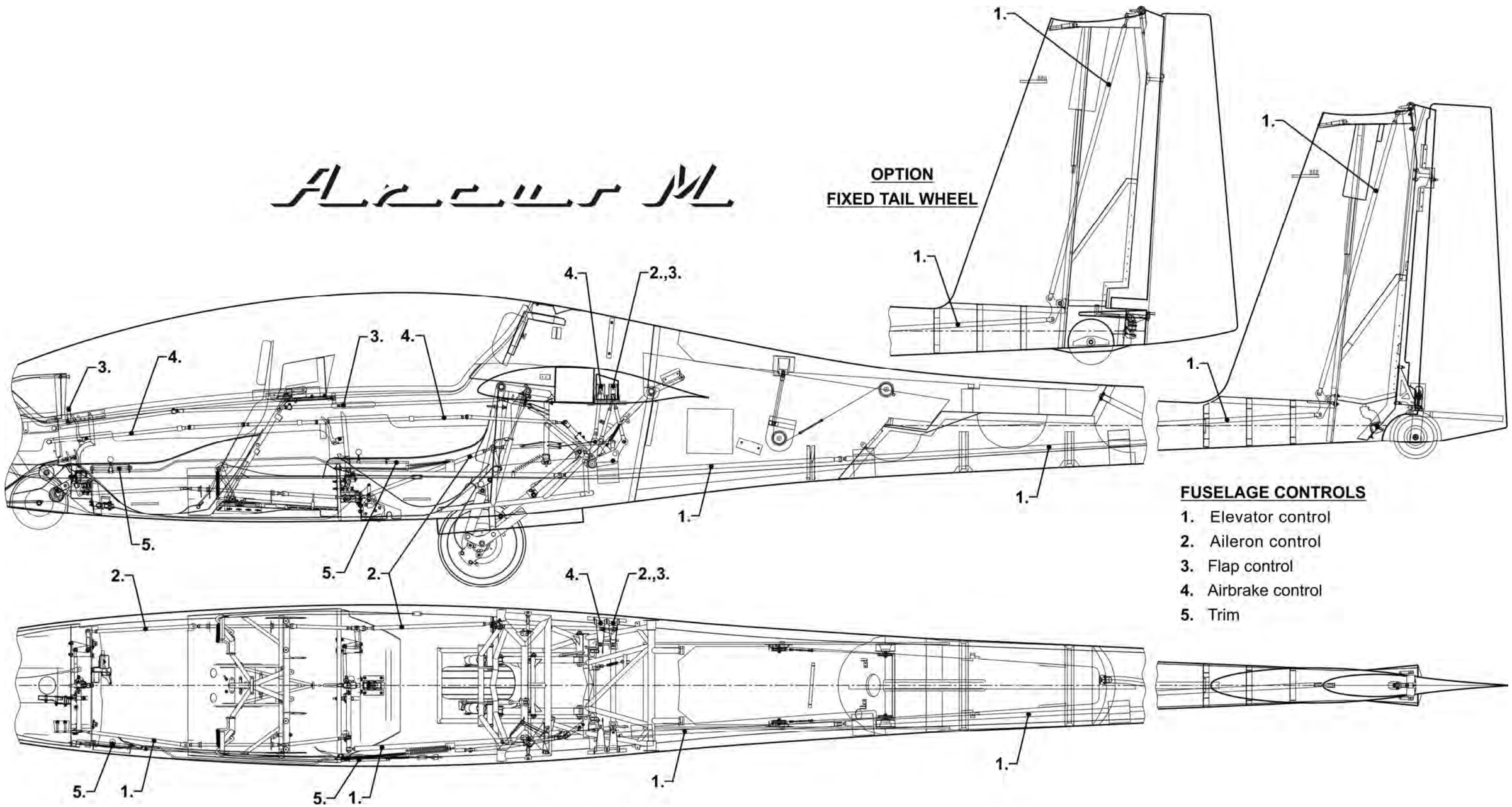
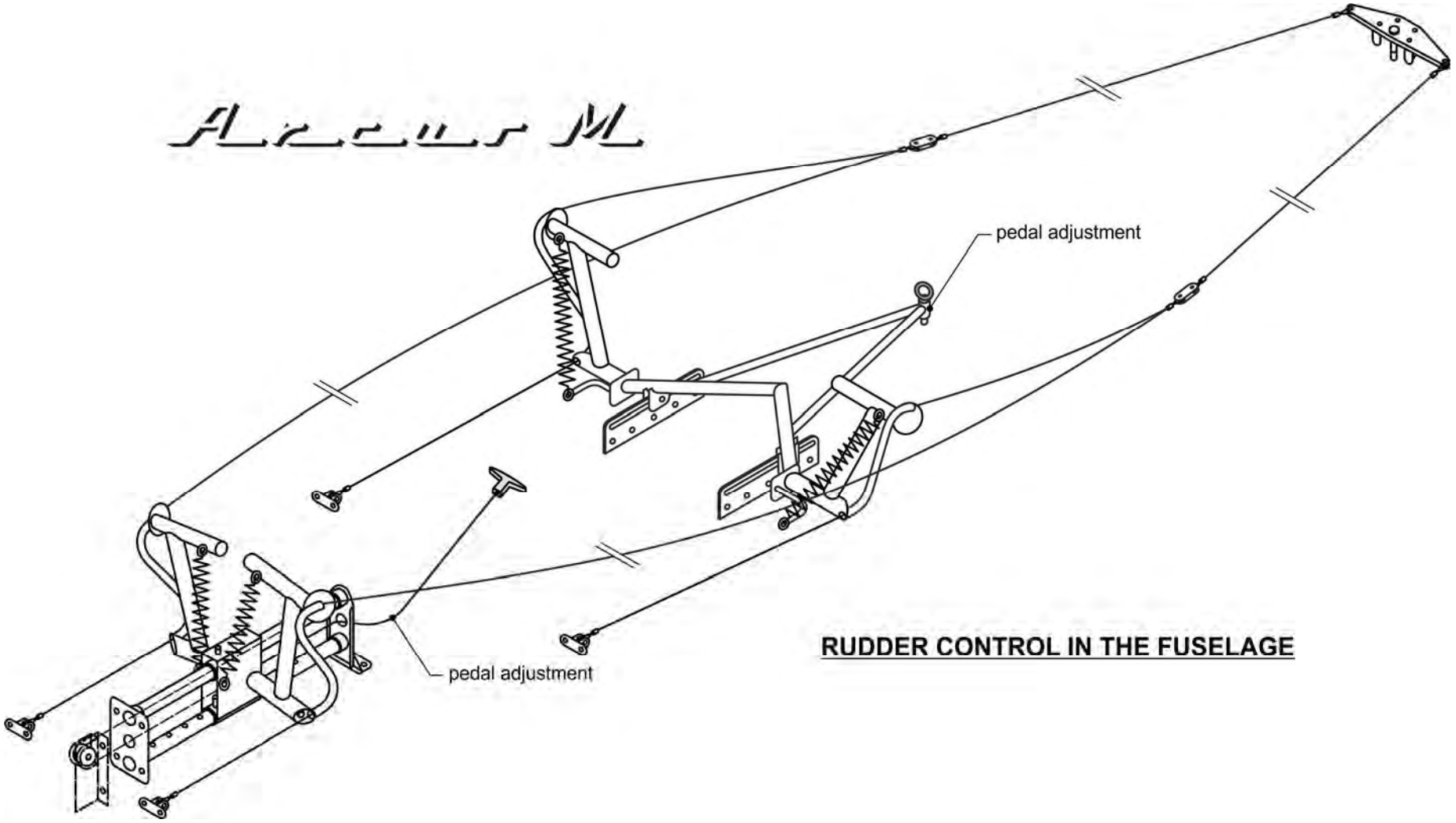
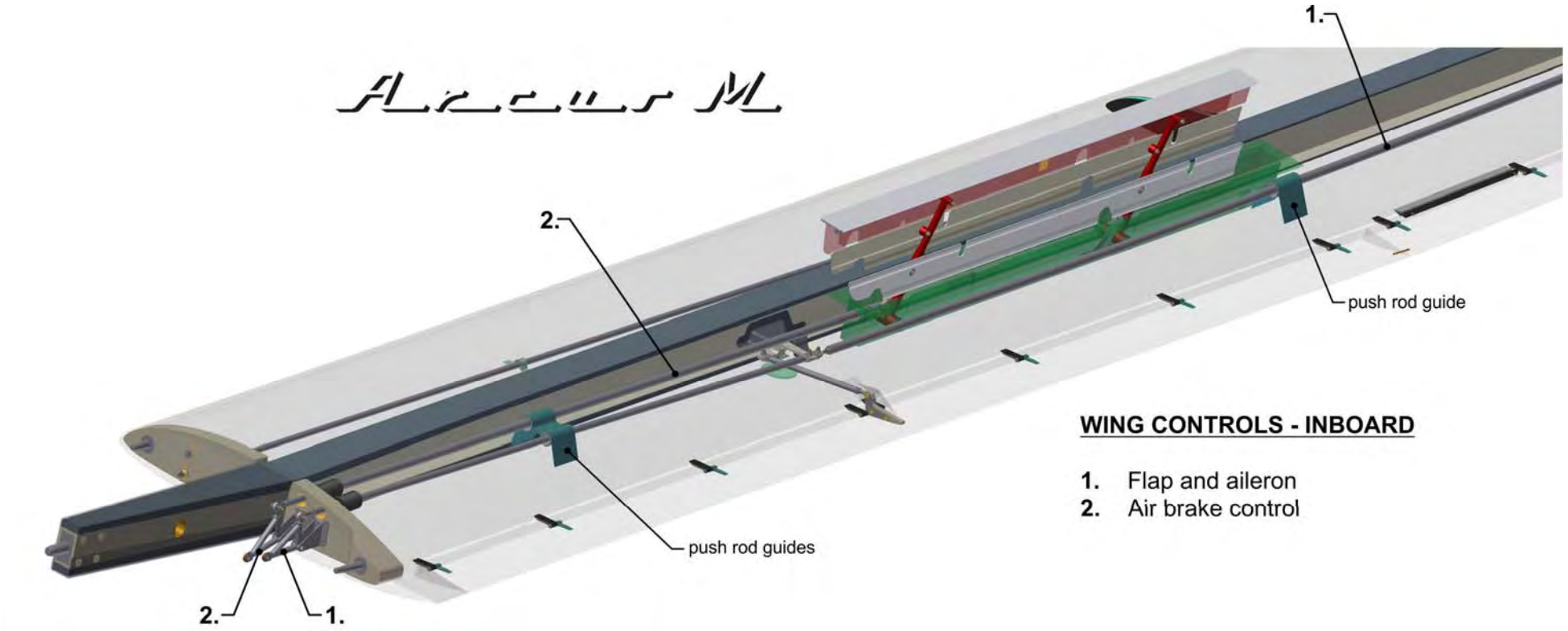

Arcus M
OPTION
FIXED TAIL WHEEL
1.
2.
3.
4.
5.
FUSELAGE CONTROLS
1. Elevator control
2. Aileron control
3. Flap control
4. Airbrake control
5. Trim

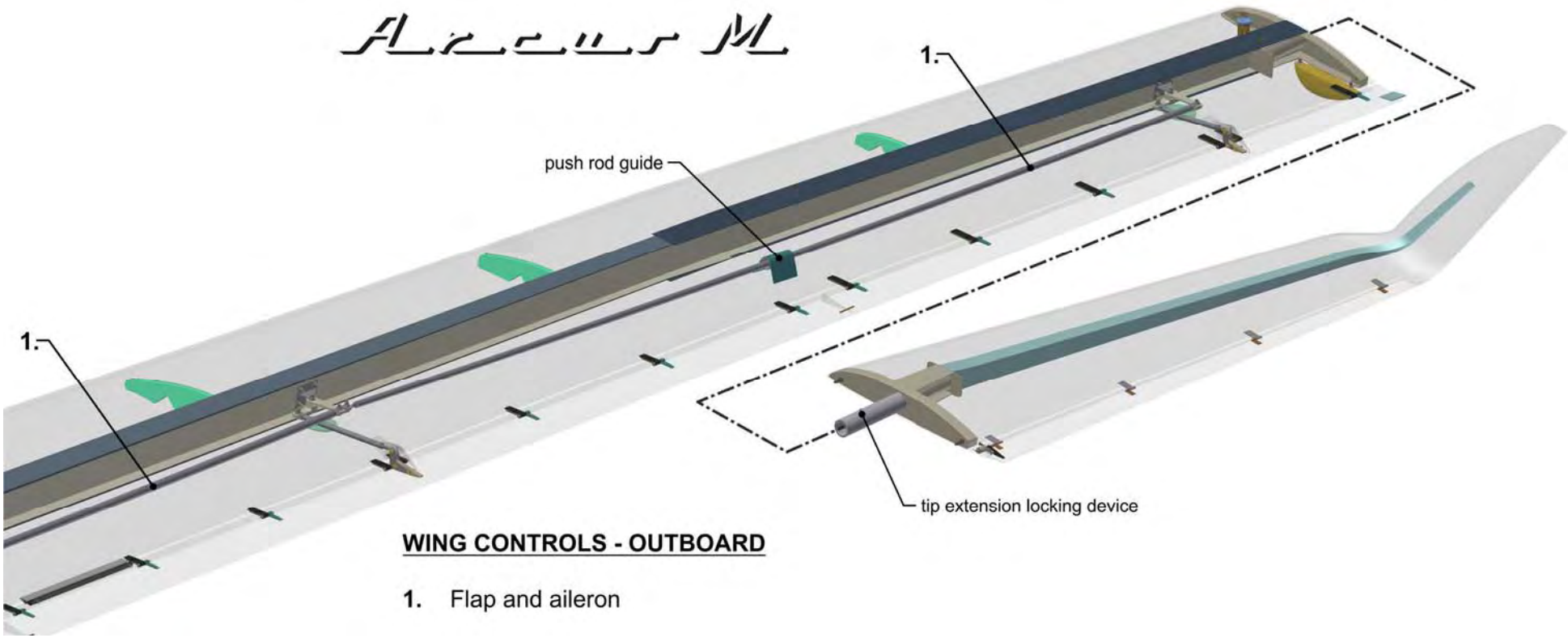


RUDDER CONTROL IN THE FUSELAGE



WING CONTROLS - INBOARD

1. Flap and aileron
2. Air brake control

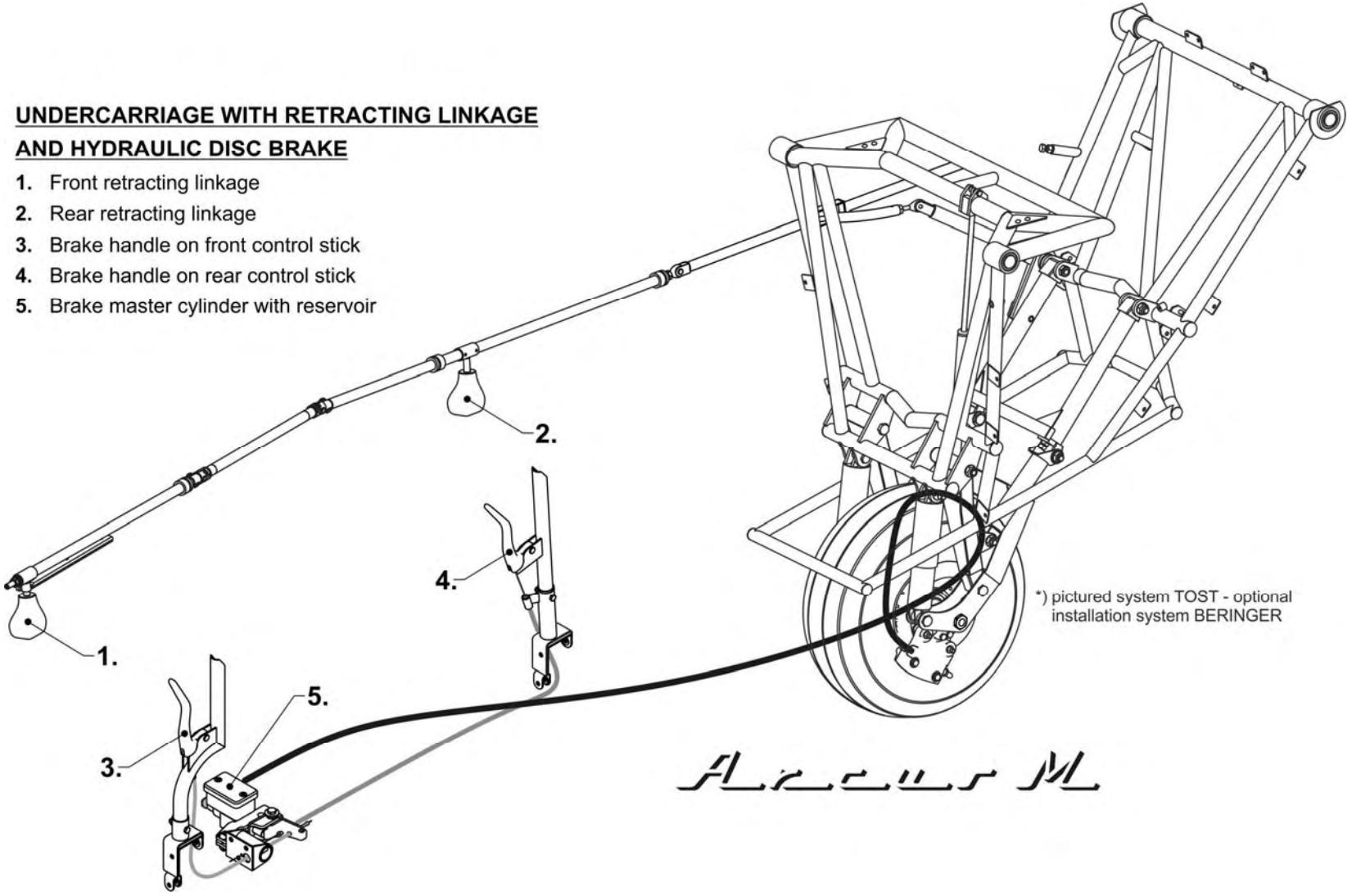


WING CONTROLS - OUTBOARD

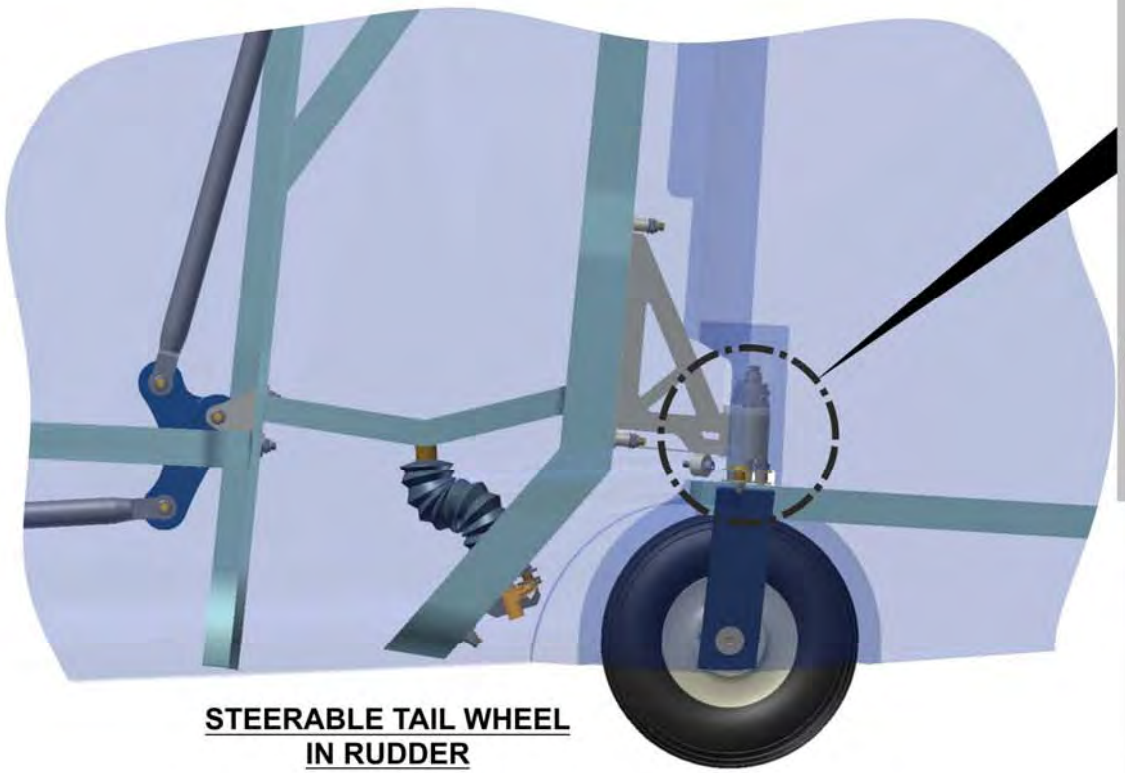
1. Flap and aileron

UNDERCARRIAGE WITH RETRACTING LINKAGE
AND HYDRAULIC DISC BRAKE

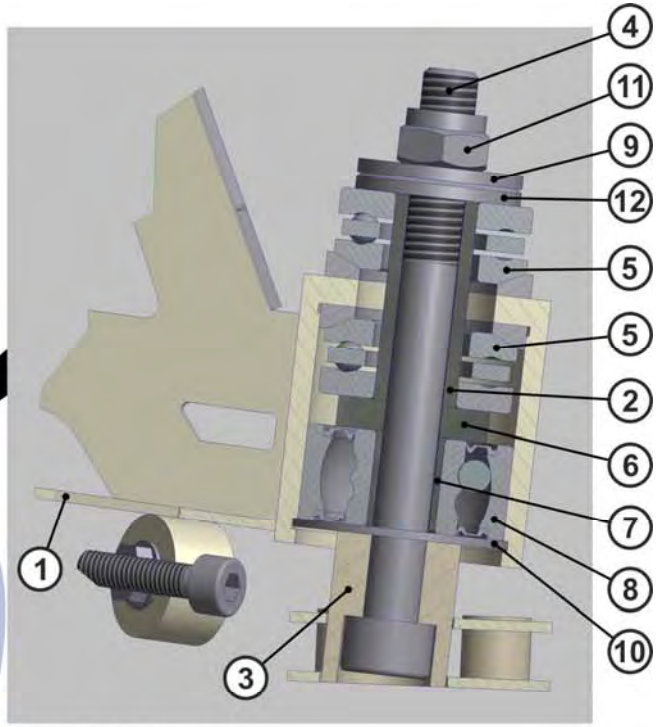
1. Front retracting linkage
2. Rear retracting linkage
3. Brake handle on front control stick
4. Brake handle on rear control stick
5. Brake master cylinder with reservoir



Arcus M

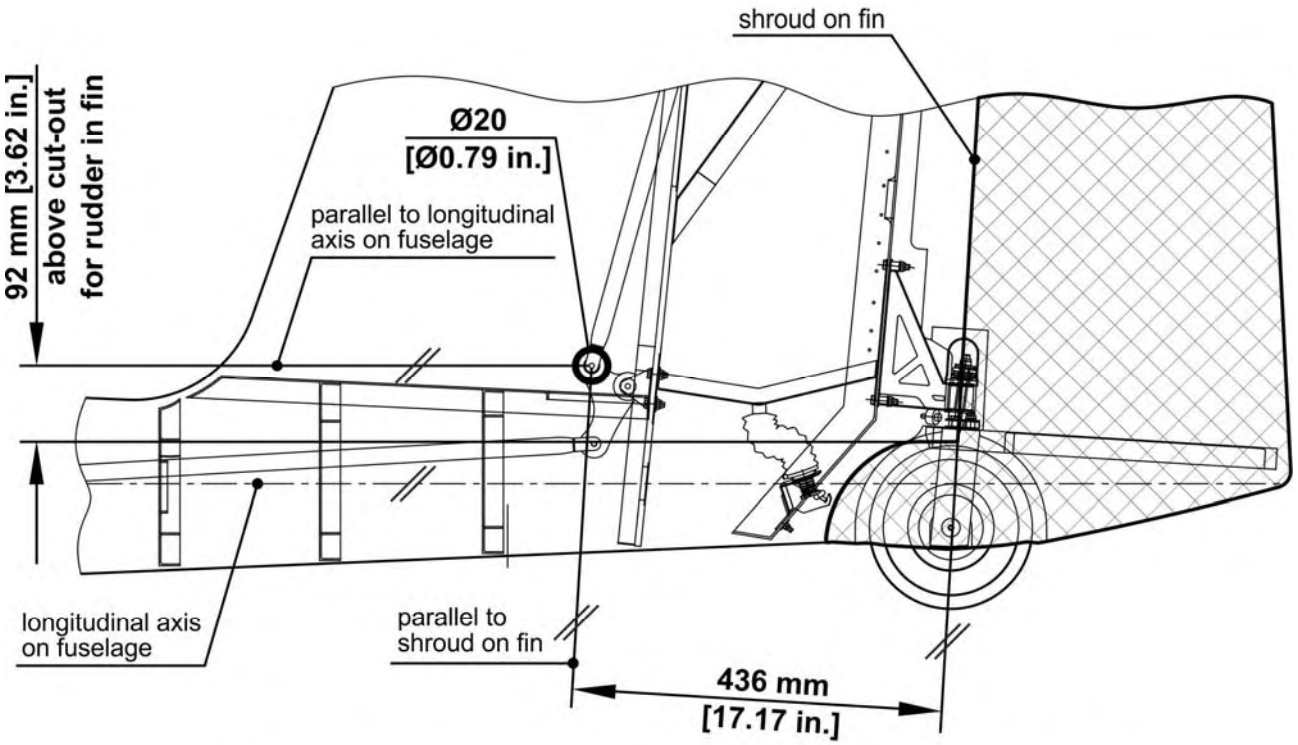


STEERABLE TAIL WHEEL IN RUDDER



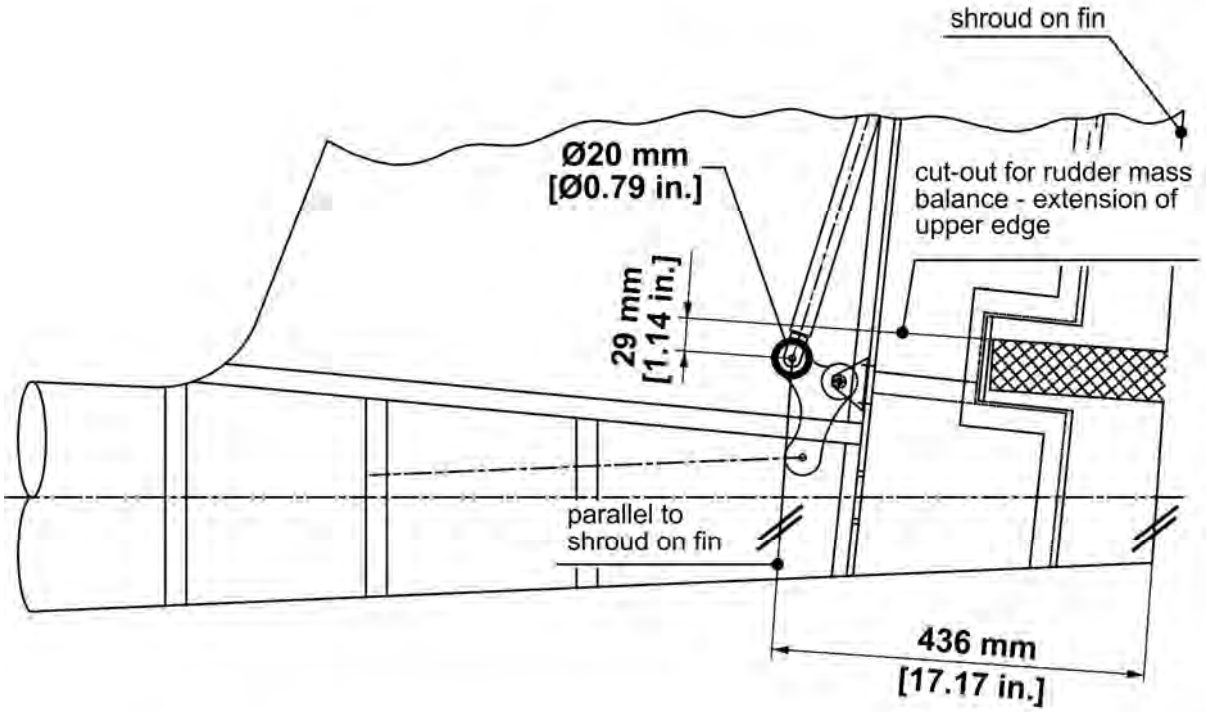
Teil	Stück	Benennung
12	1	Washer
11	1	Lock nut
10	1	Retaining ring
9	1	Washer
8	1	Self-aligning ball bearing
7	1	*Bushing tube*
6	1	Washer
5	2	Grooved ball bearing
4	1	Allen screw
3	1	Lower rudder bracket - rudder
2	1	Bushing tube
1	1	Lower rudder bracket - fin

INSPECTION OPENING IN THE FIN, LEFT SIDE
(STEERABLE TAIL WHEEL)

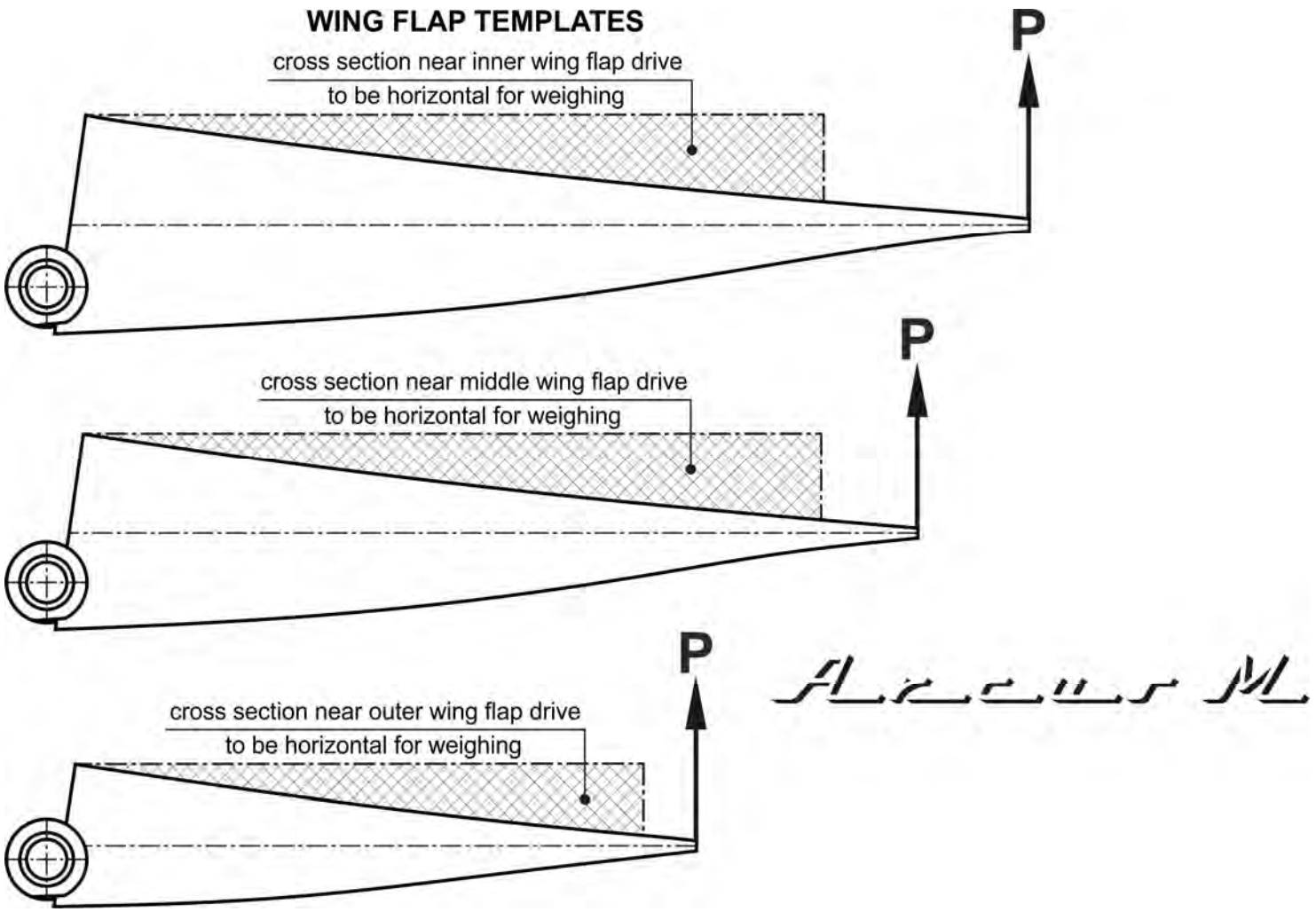


Should it become necessary to replace the vertical elevator actuating rod, an additional opening may be cut into the fin on the far side.
After inspection close the opening with tape.

INSPECTION OPENING IN THE FIN, LEFT SIDE
(OPTION - FIXED TAIL WHEEL)



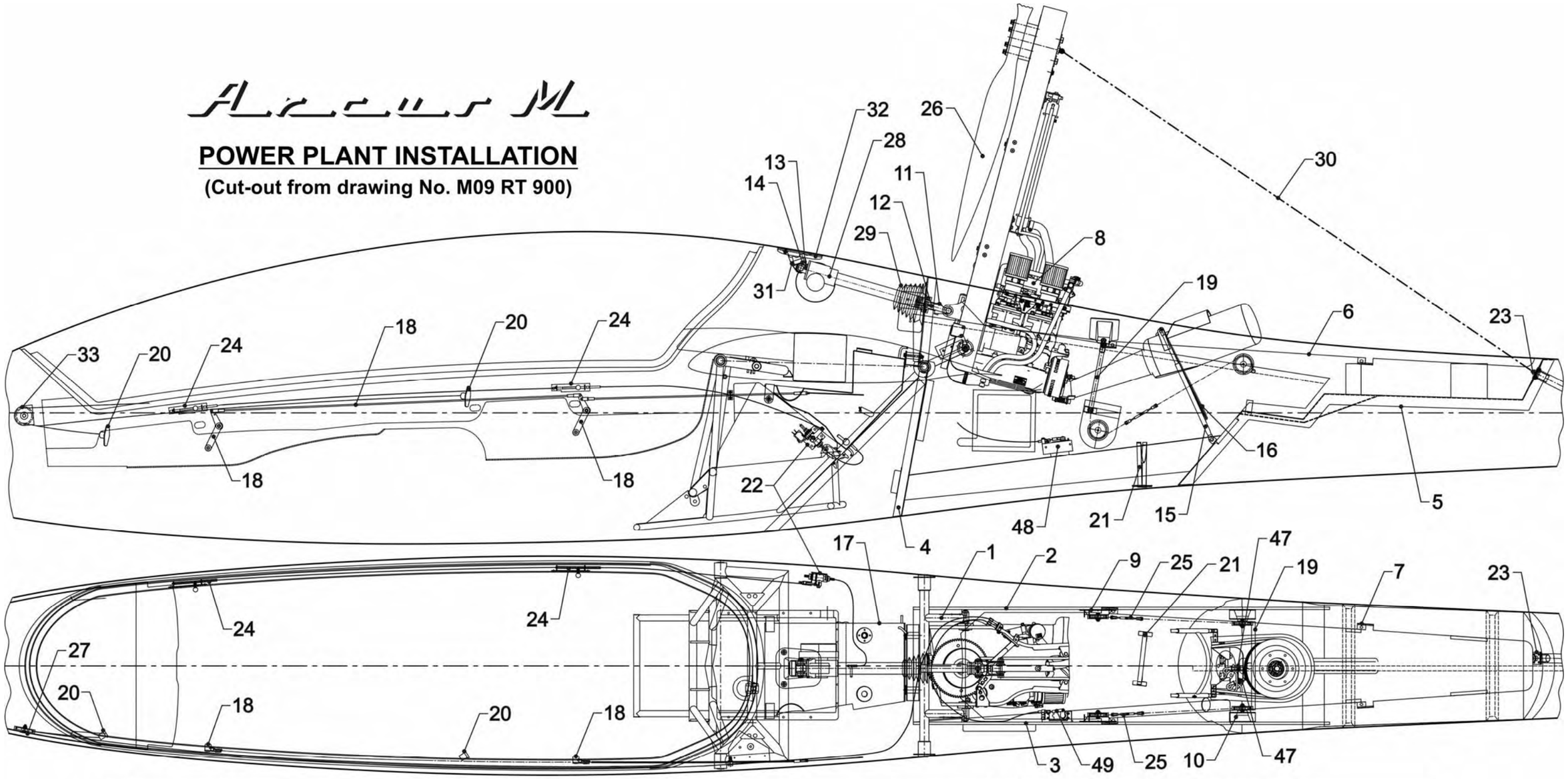
Should it become necessary to replace the vertical elevator actuating rod, an additional opening may be cut into the fin on the far side.
After inspection close the opening with tape.


WING FLAP TEMPLATES
cross section near inner wing flap drive
to be horizontal for weighing
P
cross section near middle wing flap drive
to be horizontal for weighing
P
cross section near outer wing flap drive
to be horizontal for weighing
P
Arcus M

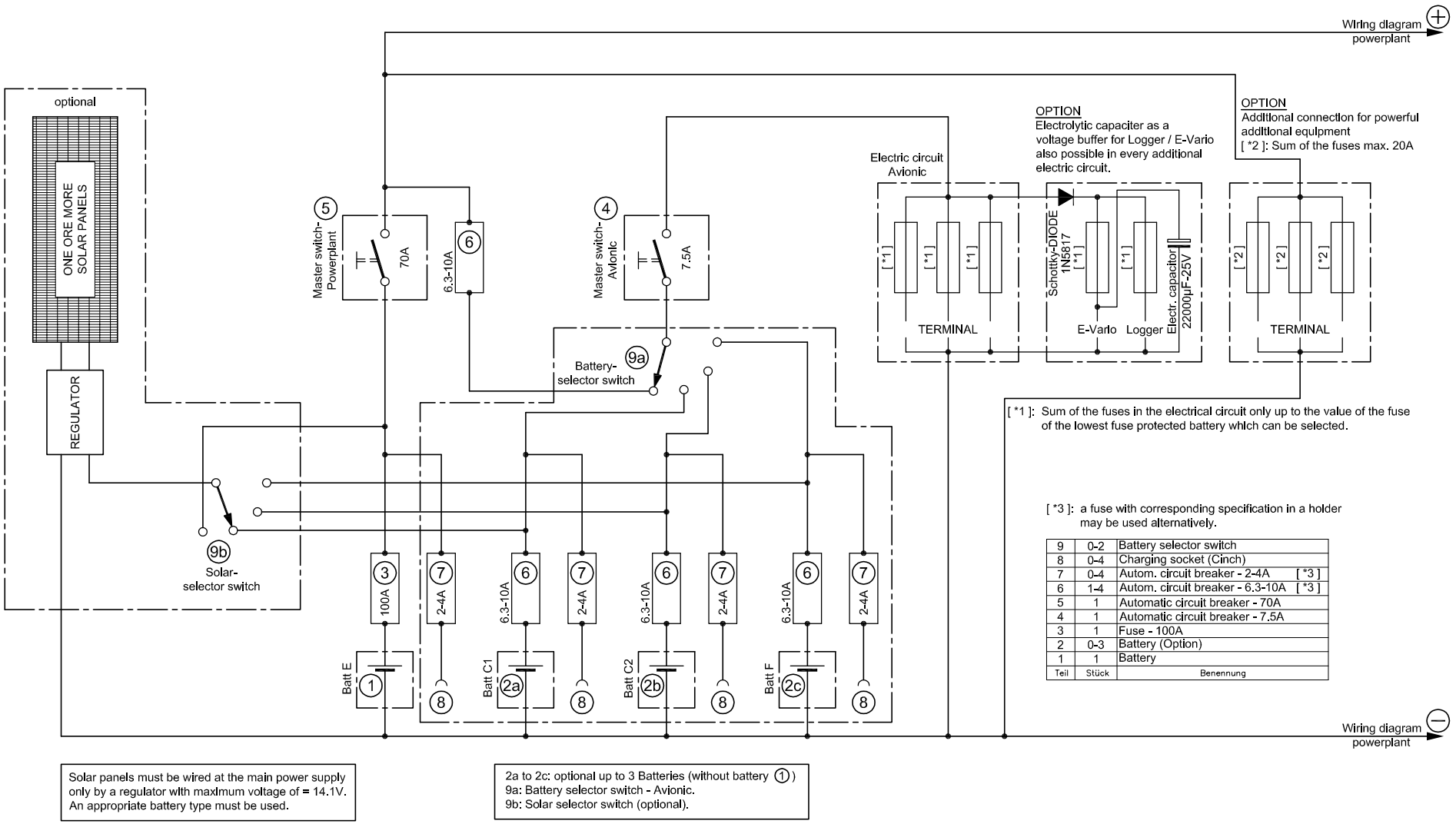
Arcus M

POWER PLANT INSTALLATION

(Cut-out from drawing No. M09 RT 900)



Teil	Zeichn.-Nr.	Benennung	Teil	Zeichn.-Nr.	Benennung	Teil	Zeichn.-Nr.	Benennung
49		Brake servo	24	M08 RT 855	Actuation of shut-off valve	12	M07 RT 871	Rear locking device for spindle drive
48	M03 RT 980	Mounting support for brake servo	23	HM06-10.310	Mounting bracket for arresting cable	11	M09 RT 870	Rear mounting support for spindle drive
47	ZRT 009	Proximity switch	22	M03 RT 870	Shut-off valve mounting plate	10	M07 RT 626	Mounting bracket for rear cable pulley
33	ZRB 153	Cable pulley	21	M09 RT 888	Exhaust bedding	9	M07 RT 625	Mounting bracket for front cable pulley
32	M03 RG 167-T.2	Attachment for spindle drive in fuselage	20		Actuation handle for propeller brake (plastic black)	8	M09 RT 884	Powerplant assembly
31	M07 RT 873	Mounting support for spindle drive	19	M03 RT 911	Actuation of engine compartment doors	7	M03 RG 166	Hinges for engine compartment doors
30		Arresting cable (B 3.2 - LN 9374)	18	M09 RT 804	Throttle control rods with throttle lever	6	M09 RT 972	Engine compartment doors
29		Rubber gaiter (855 711 115 - AUDI)	17	M09 RT 880	Tank	5	M07 RT 616	Engine compartment rear panel
28		DC-spindle drive (ATL10RN1 C250 BA FCMNO)	16		Tension spring (1.5x13.2x209 XD VZ - GUTEKUNST)	4	M07 RT 615	Engine compartment front panels
27	M08 RT 808	Mounting bracket for cable pulley	15	M09 RT 889	Exhaust attachment	3	M09 RT 830	Engine compartment left panel
26		Propeller (KS-1G-160-R-120 or BM-G-160-R-120-1)	14	ZRT 003	Mounting support spindle drive (rubber element)	2	M07 RT 613	Engine compartment right panel
25	ZRB156	Turnbuckle - M4	13	M07 RT 877-T.1	Front mounting support for spindle drive	1	M09 RT 850	Fuselage framework with powerplant mounting

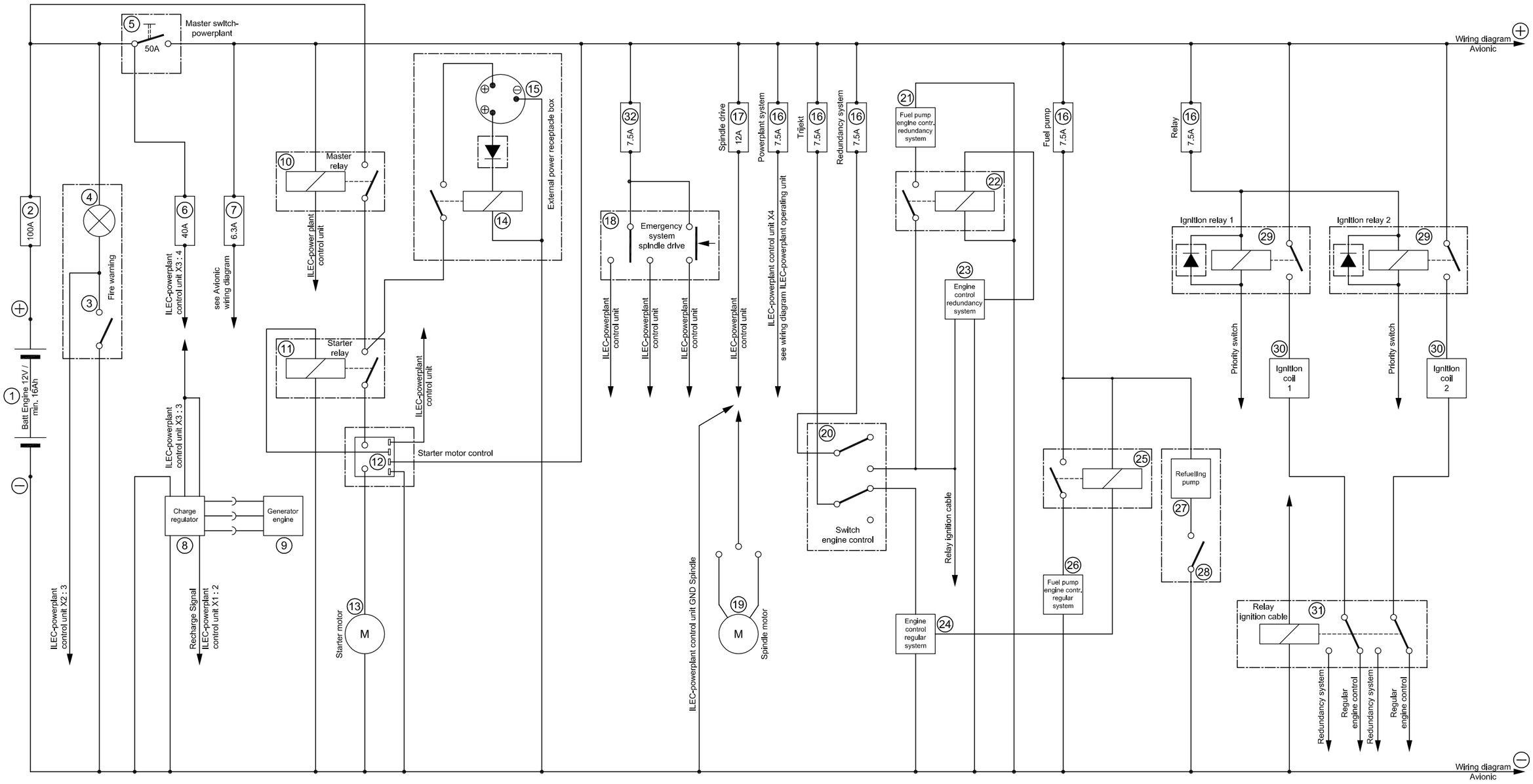


9	0-2	Battery selector switch
8	0-4	Charging socket (Cinch)
7	0-4	Autom. circuit breaker - 2-4A [*3]
6	1-4	Autom. circuit breaker - 6.3-10A [*3]
5	1	Automatic circuit breaker - 70A
4	1	Automatic circuit breaker - 7.5A
3	1	Fuse - 100A
2	0-3	Battery (Option)
1	1	Battery
Teil	Stück	Benennung

Solar panels must be wired at the main power supply only by a regulator with maximum voltage of = 14.1V. An appropriate battery type must be used.

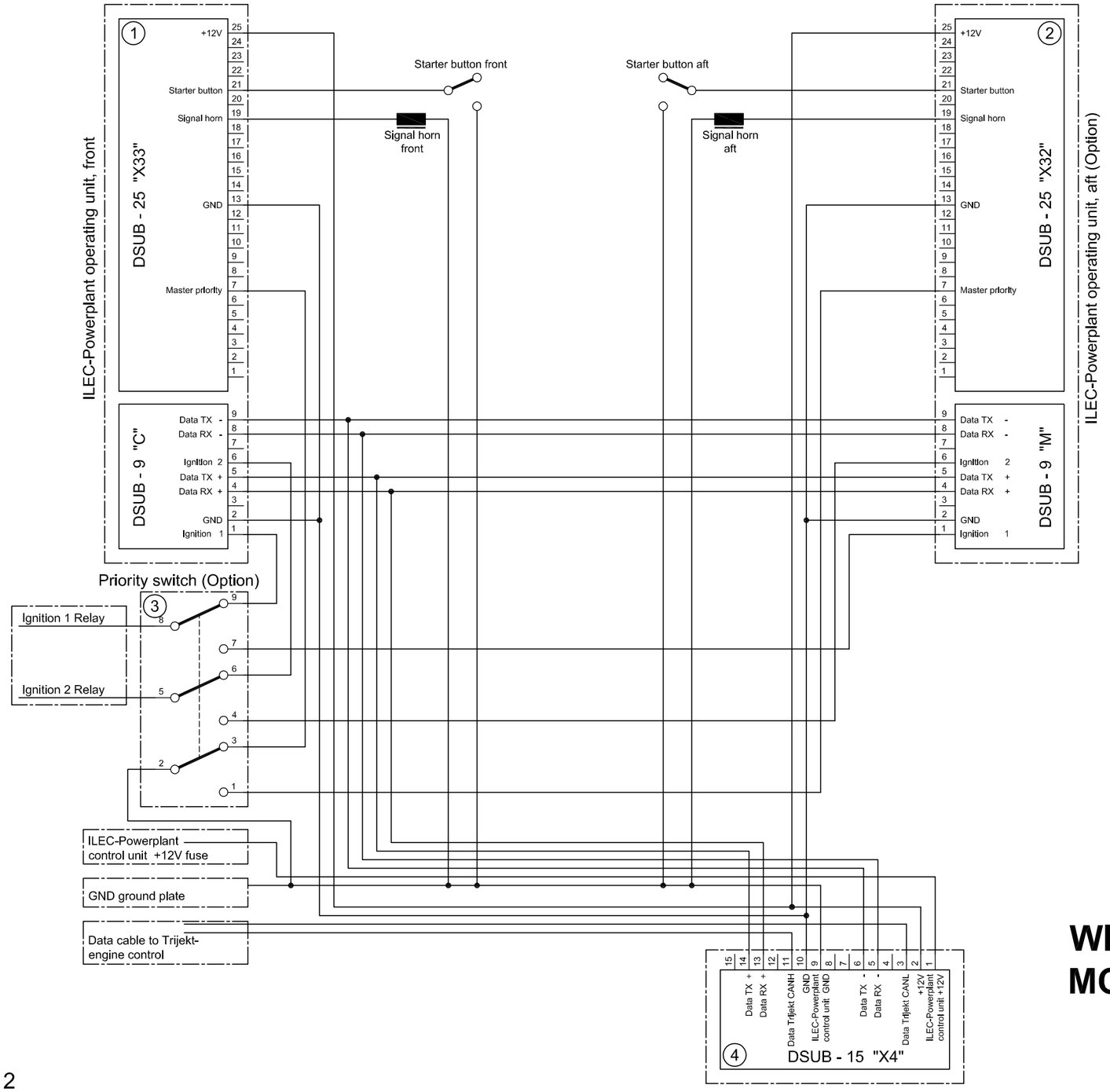
2a to 2c: optional up to 3 Batteries (without battery ①)
9a: Battery selector switch - Avionic.
9b: Solar selector switch (optional).

WIRING DIAGRAM - AVIONIC



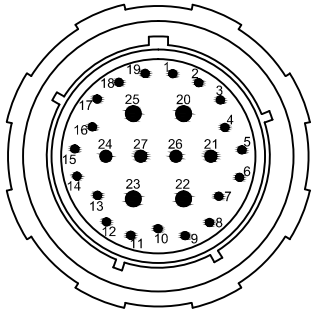
			22	1	Relay	11	1	Starter relay
32	1	Self-resetting fuse - 7.5A	21	1	Fuel pump	10	1	Relay
31	1	Relay	20	1	Switch engine control	9	1	Generator
30	2	Ignition coil	19	1	DC spindle drive	8	1	Charge regulator
29	1	Relay	18	1	Emergency switch spindle drive	7	1	Automatic circuit breaker - 6.3A/NA
28	1	Toggle switch refuelling	17	1	Automatic circuit breaker - 12A	6	1	Automatic circuit breaker - 40A
27	1	Refuelling pump	16	3	Automatic circuit breaker - 7.5A	5	1	Automatic circuit breaker - 50A
26	1	Fuel pump	15	1	External power receptacle box (Option)	4	1	Blinking LED, red
25	1	Relay	14	1	Relay	3	1	Temperature switch
24	1	Engine control regular system	13	1	Starter motor	2	1	Fuse - 100A
23	1	Engine control redundancy system	12	1	Starter motor control	1	1	Starter battery
Teil	Stück	Benennung	Teil	Stück	Benennung	Teil	Stück	Benennung

WIRING DIAGRAM - POWERPLANT



Teil	Stück	Benennung
4	1	Data-plug at ILEC-Powerplant control unit
3	1	Priority switch (Opt.)
2	1	Powerplant operating unit, aft (Opt.)
1	1	Powerplant operating unit, front

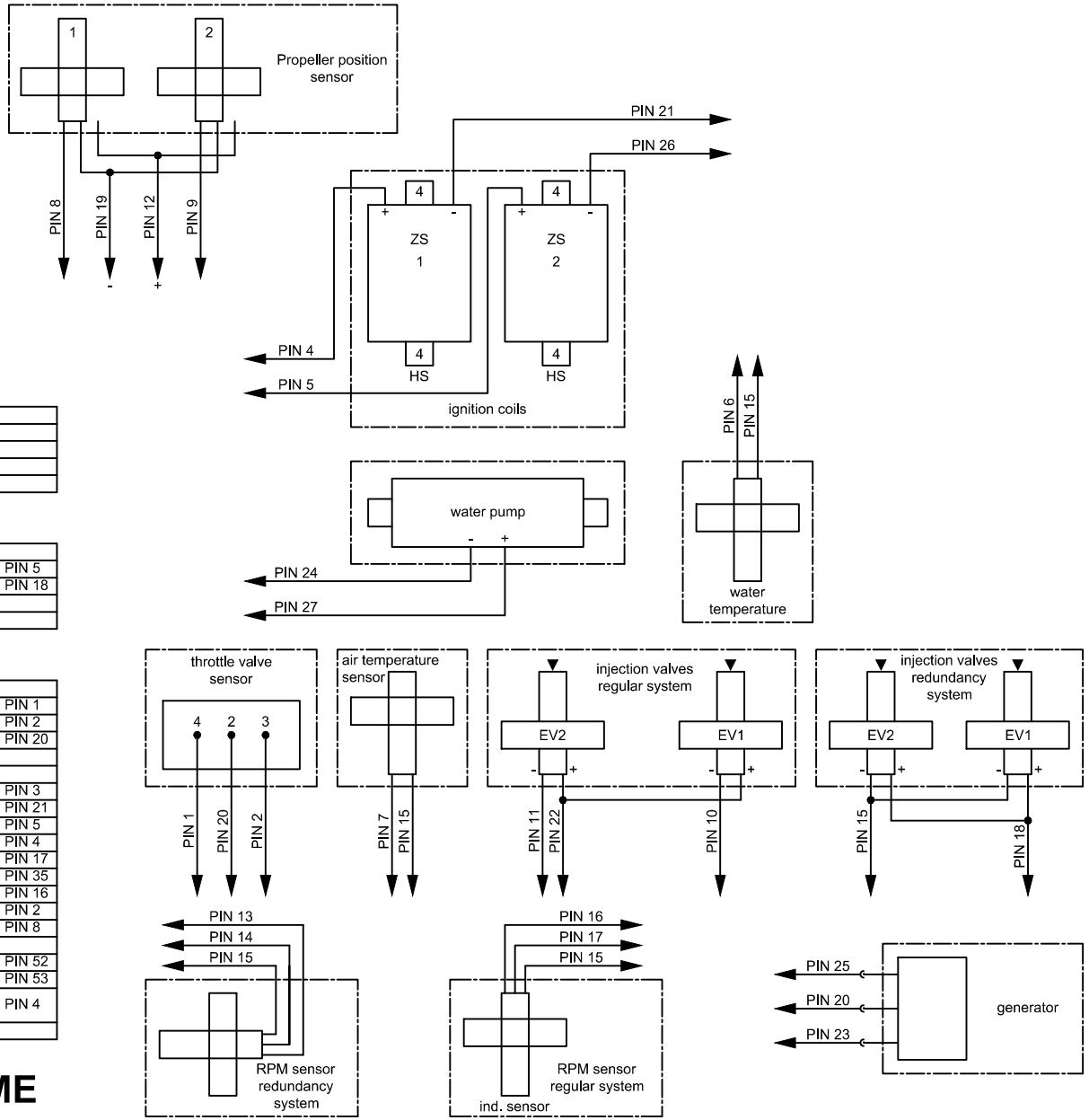
WIRING DIAGRAM ILEC - MCU II-OPERATING UNIT



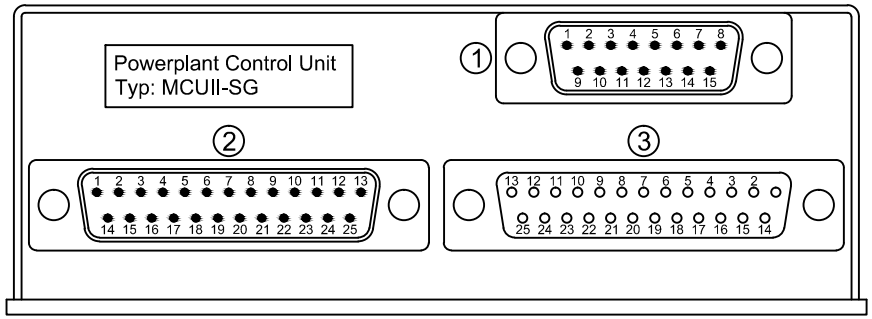
PIN groß		
Slot	Description	Target
25	Generator line 1	Charge regulator
20	Generator line 2	Charge regulator
23	Generator line 3	Charge regulator
22	Switched +line	Plug X5 to fuse panel

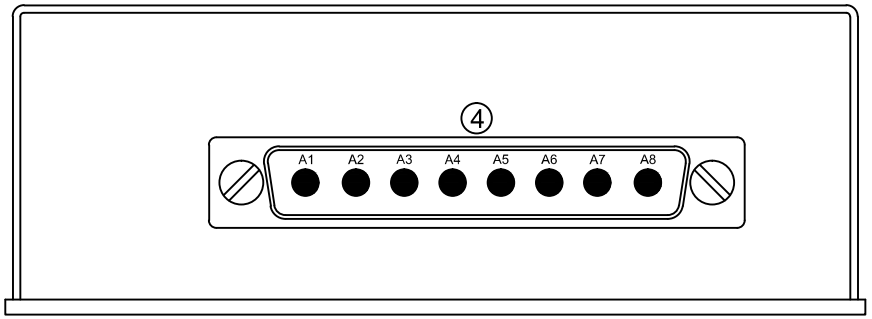
PIN mittel			
Slot	Description	Target	
24	Water pump GND	ILEC MCU II-SG - consumer plug (X2):	PIN 5
27	Water pump +12V	ILEC MCU II-SG - consumer plug (X2):	PIN 18
26	Ignition coil 2 GND	Relay ignition switch	
21	Ignition coil 1 GND	Relay ignition switch	

PIN klein			
Slot	Description	Target	
1	Throttle valve GND	Engine control regular system - Trijekt	PIN 1
2	Throttle valve signal	Engine control regular system - Trijekt	PIN 2
3	Throttle valve +5V	Engine control regular system - Trijekt	PIN 20
4	Ignition coil 1 +12V	Relay ignition 1 - ground plate	
5	Ignition coil 2 +12V	Relay ignition 2 - ground plate	
6	Water temperature signal	Engine control regular system - Trijekt	PIN 3
7	Air temperature signal	Engine control regular system - Trijekt	PIN 21
8	Propeller position signal 1	ILEC MCU II-SG - sensor plug (X1):	PIN 5
9	Propeller position signal 2	ILEC MCU II-SG - sensor plug (X1):	PIN 4
10	Injection valve 1 - regular system GND	Engine control regular system - Trijekt	PIN 17
11	Injection valve 2 - regular system GND	Engine control regular system - Trijekt	PIN 35
12	Propeller position +12V	ILEC MCU II-SG - sensor plug (X1):	PIN 16
13	RPM Engine control redundancy system-signal	Engine control redundancy system	PIN 2
14	RPM Engine control redundancy system-GND	Engine control redundancy system	PIN 8
15	GND	Ground plate	
16	RPM Regular system - GND	Engine control regular system - Trijekt	PIN 52
17	RPM Regular system - signal	Engine control regular system - Trijekt	PIN 53
18	Injection valve 1/2 - Engine control redundancy system +12V	Engine control redundancy system	PIN 4
19	GND	Ground plate	



CONNECTOR ENGINE TO AIRFRAME





①	Dataplug : X4 - Typ: DSUB, 15-pin, male	
Pin	Description	Direction
1	MCUII-SG +12V	IN
2	MCUII-BG +12V	OUT
3	DATA Trijekt CAN-L	IN/OUT
4		
5	RS422 - TX-	OUT
6	RS422 - RX-	IN
7		
8		
9	MCUII-SG GND	IN
10	MCUII-BG GND	OUT
11	DATA Trijekt CAN-H	IN/OUT
12		
13	RS422 - TX+	OUT
14	RS422 - RX+	IN
15		

②	Sensorplug: X1 - Typ: DSUB, 25-pin, male	
Pin	Description	Direction
1		
2		
3		
4	PROP_POS2_SIGNAL	IN
5	PROP_POS1_SIGNAL	IN
6	Fuel level sensor fuselage tank - signal	IN
7		
8		
9	Limit switch "Retracted"	IN
10	Limit switch "Extended"	IN
11	Switch "Fuel cock closed"	IN
12	RECHARGE_SIGNAL	IN
13		
14		
15		
16	RPM_PROP_SENSOR +12V	OUT
17	Fuel level sensor fuselage tank +5V	OUT
18	Fuel level sensor fuselage tank GND	OUT
19		
20		
21		
22		
23		
24		
25		

③	Consumerplug: X2 - Typ: DSUB, 25-pin, female	
Pin	Description	Direction
1	Brake-Servo -	OUT
2		
3	Fire-LED	OUT
4		
5	Water pump GND	OUT
6		
7		
8		
9	Universal starter control	OUT
10		
11		
12	Emergency system spindle drive-extension	IN
13	Emergency switch spindle drive	IN
14	Brake-servo +	OUT
15		
16		
17		
18	Water pump +12V	OUT
19		
20		
21		
22		
23		
24		
25	Emergency system spindle drive-retraction	IN

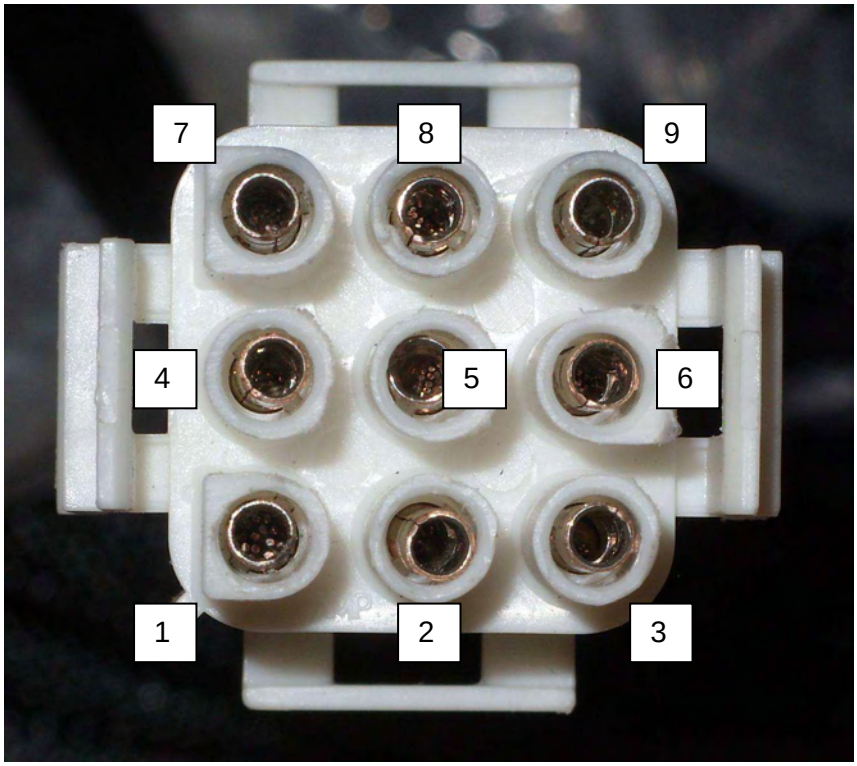
④	Powerplug: X3 - Typ: Provertha MDT8W8P60G248 with pin contact P5620G2	
Pin	Bezeichnung	Richtung
A1	MCUII-SG +12V	IN
A2	MCUII-SG GND	IN
A3	Starter motor +12V	IN
A4	Alternator +12V	OUT
A5	Spindle drive +12V	IN
A6	Spindle drive IN/OUT	OUT
A7	Spindle drive GND	IN
A8	Spindle drive retraction / extension	OUT

PIN ASSIGNMENT - MCUII CONTROL UNIT

Pin Assignment – Trijekt T101– Regular Engine control system

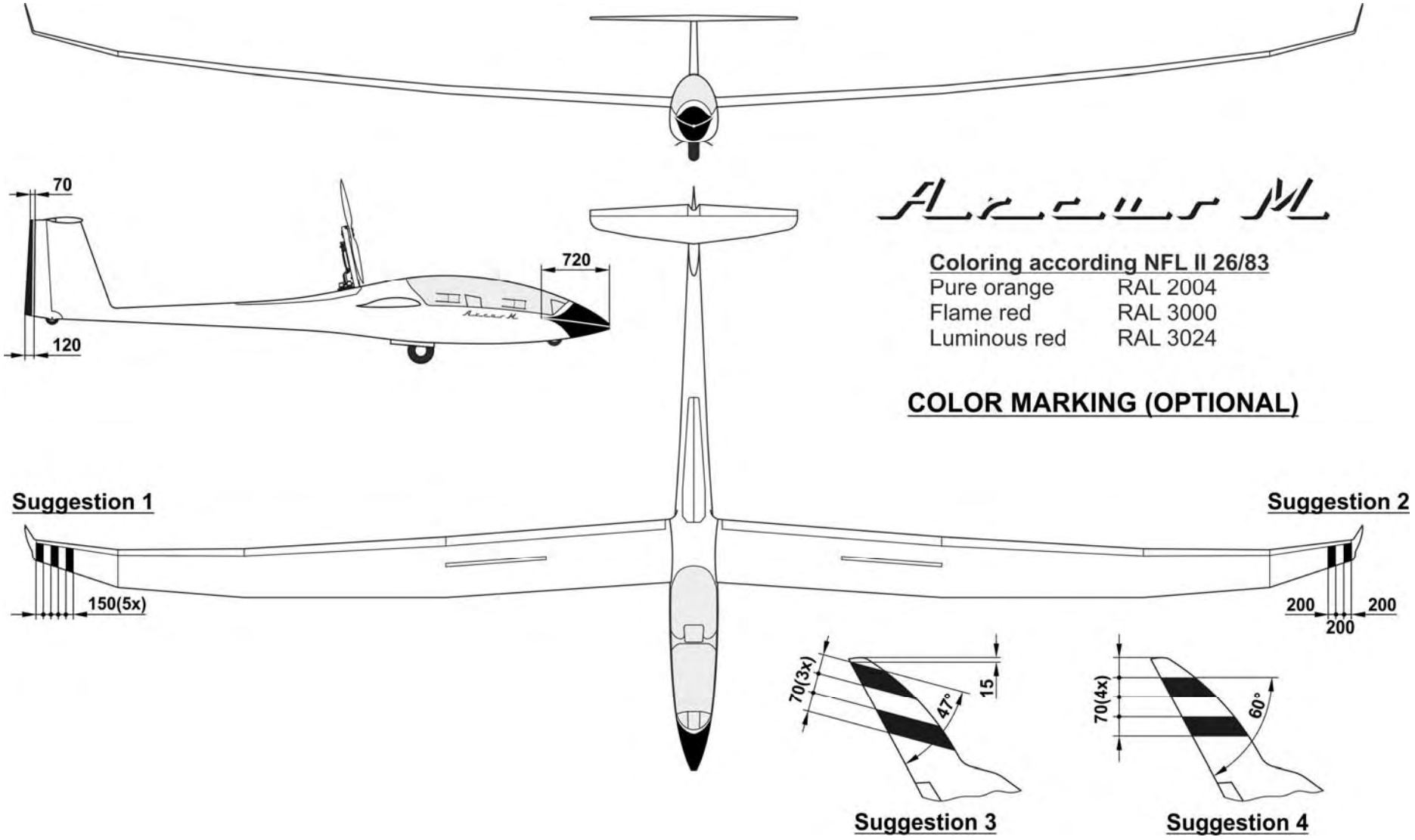
Pin	Description	Pin	Description	Pin	Description
1	Throttle position sensor - GND				
2	Throttle position sensor – signal	**20**	Throttle position sensor +5V	**38**	-
3	Coolant temperature – signal	**21**	Air temperature signal	**39**	-
4	-	**22**	-	**40**	-
5	-	**23**	-	**41**	Ignition coil 1
6	-	**24**	-	**42**	Ignition coil 2
7	CAN L	**25**	CAN H	**43**	-
8	PC Interface Rxd	**26**	PC Interface Txd	**44**	-
9	-	**27**	-	**45**	-
10	Relay fuel pump	**28**	-	**46**	-
11	-	**29**	-	**47**	-
12	-	**30**	-	**48**	-
13	-	**31**	-	**49**	-
14	-	**32**	-	**50**	-
15	-	**33**	-	**51**	-
16	-	**34**	-	**52**	
17	Injection valve 1 (Ignition side)	**35**	Injection valve 2 (driving side)	**53**	RPM Sensor (inductive)
18	Steady Plus Battery	**36**	Power GND	**54**	RPM Sensor GND
19	-	**37**	Switched +12V	**55**	Switched +12V

Pin Assignment – Redundancy engine control system:



Redundancy engine control system, plug „68“
Type: AMP Universal MATE-N-LOK 9-pin, female

Pin	Description
1	Redundancy system +12 V
2	RPM Sensor Redundancy system (inductive)
3	Ignition coil 2 Redundancy system
4	Injection valve 1 + 2 Redundancy system 12V
5	Fuel pump Redundancy system + 12V
6	GND
7	Redundancy system GND
8	RPM Sensor Redundancy system GND
9	Ignition coil 1 Redundancy system


70
720
120
Arcus M
Coloring according NFL II 26/83
Pure orange RAL 2004
Flame red RAL 3000
Luminous red RAL 3024
COLOR MARKING (OPTIONAL)
Suggestion 1
150(5x)
Suggestion 2
200
200
200
70(3x)
47°
15
Suggestion 3
70(4x)
60°
Suggestion 4

CHECK LIST for Ser.-No..... Registration: ..... Date:……..

MAINTENANCE ACTION: O Annual inspection

O Inspection at engine operation time: ...../.....
Total time / since last inspection

O Other:…….

I. Powerplant unit

	INSPECTION ITEMS (LINK, REMARK)	INSPECTION MEASURE	Maintenance / Replacement	Findings (Sign. Inspector)
1.0.1	Inspection of engine	O Check whether due inspections or maintenance according to the current issue of the "Manual for the engine SOLO Type 2625-02i" were conducted	for details see engine manual	
1.0.2	Inspection of propeller	O Check whether due inspections and maintenance according to the current issue of the maintenance documentation for the propeller were conducted.	for details see propeller manual	
1.1	General visual inspection of powerplant unit in engine compartment	Pay particular attention to damages at: O Starter motor, ignition boxes, Cooling water distribution box; Mounting of cooler and cooling water pump O Cooling water pump and -hoses O Cooling water quantity O Fuel hoses and associated connectors and couplings O Injection system O Exhaust system O Engine and propeller mounting	Depending on condition	
1.2	Connection, attachments, joints (MM section 4.4)	O Check all accessible connections, attachments, joints and locks (screw, nut, hose- and cable connections)	Depending on condition	
1.3	Propeller pylon (MM section 5.9)	O Check for damages/cracks O Check tight fit of propeller pylon mounting and the attachment of the spindle drive at the propeller pylon	Depending on condition	
1.4	Propeller mount	O Check locking wire of propeller mounting bolts O Check play of propeller mounting: Move propeller tip fore and aft. If play is noticeable, contact manufacturer for advice O Check the propeller mounting for easy movement around its axis of rotation (upper belt pulley)	Depending on condition	
1.5	V-belt set of drive transmission (MM section 4.2.3 and 5.11)	O Check V-belt set and belt pulleys for wear and damages O Check belt tension O Check ball bearings of belt guide rollers for free movement O Observe replacement interval.	Depending on condition of V-belt set every 5 years or 50 h engine operation time	

CHECK LIST for Ser.-No..... Registration: ..... Date:……..

MAINTENANCE ACTION: O Annual inspection

O Inspection at engine operation time: ...../.....
Total time / since last inspection

O Other:…….

I. Powerplant unit (continued)

	INSPECTION ITEMS (LINK, REMARK)	INSPECTION MEASURE	Maintenance / Replacement	Findings (Sign. Inspector)
1.6.1	Manual propeller brake (MM section 5.5)	O Check effectiveness and function. O Check brake lever and Bowden cable for damage and ease of movement. O Compression spring has to move brake lever to upper stop of the guiding slot. O If brake handle is release, the gap between brake drum and brake pad has to be at least 0,5 mm. O Observe condition and sufficient residual thickness of brake pad.	Depending on condition	
1.6.2	Automatic propeller brake (brake servo) (MM section 5.5)	O Check effectiveness and function. O Check brake servo and Bowden cable for damage and ease of movement. O With brake completely released the gap between brake drum and brake pad has to be at least 0,5 mm.	Depending on condition	
1.7	Throttle control	O Check if full throttle and idle position of throttle is achieved properly. O Check mounting of throttle cable at throttle axis.	Depending on condition	
1.8	Air intake filter	O Check for damages O Check correct mounting O Clean dirty air intake filter with gasoline	Depending on condition	
1.9	Exhaust system (MM section 5.15)	O Check muffler and exhaust manifold for cracks O Check setting of muffler O Check operation and ease of movement of guide mechanism while extending and retracting the powerplant. O Check joint between muffler and exhaust manifold for free movement and wear.	Depending on condition	

CHECK LIST for Ser.-No..... Registration: ..... Date:……..

MAINTENANCE ACTION: O Annual inspection

O Inspection at engine operation time: ...../.....
Total time / since last inspection

O Other:…….

2. Propeller pylon and pivoting mechanism

	INSPECTION ITEMS (LINK, REMARK)	INSPECTION MEASURE	Maintenance / Replacement	Findings (Sign. Inspector)
2.1	Propeller pylon and mounting (MM section 5.9)	O Check mounting of propeller pylon in fuselage for play and tight fit of screw connections	Depending on condition	
2.2	Spindle drive (MM sections 4.4, 5.7 and 5.13)	O Check function of spindle drive. O Check front and rear mounting bracket of spindle drive. O Check front and rear spindle drive mounting for play (no noticeable play permitted). O Check tight fit and condition of mounting of spindle drive at front mounting bracket, including zero-play mounting of bracket at fuselage. O Check tight fit and condition of mounting of spindle drive at rear mounting bracket. O Check attachment and condition of both lateral locking plates between telescopic tube and connecting fork. O Check attachment and condition of spindle drive overload device (plastic sleeve between telescopic tube and connecting fork). O Check attachment, condition and funktion of limit stop „Extended“ at the spindle drive. O Check condition of gaiter.	Depending on condition	
2.3	Pylon arresting wire (MM section 5.6 and 4.2.3)	O Check conditions of arresting wire including clamped joints. O Arresting wire setting: With fully extended powerplant (stopped by limit switch „Extended“) the arresting wire has to have still app. 10 to 15 mm play before being tight. O Arresting wire setting for retraction of powerplant: because of the rubber cord the arresting wire must not fall loose. O Check condition of cable guide at rear wall of engine compartment and of mounting bolt at propeller pylon. O Observe replacement intervals.	Depending on condition. Replace pylon arresting wire at least every 50 hours of engine operating time	

CHECK LIST for Ser.-No..... Registration: ..... Date:……..

MAINTENANCE ACTION: O Annual inspection

O Inspection at engine operation time: ...../.....
Total time / since last inspection

O Other:…….

2. Propeller pylon and pivoting mechanism (continued)

	INSPECTION ITEMS (LINK, REMARK)	INSPECTION MEASURE	Maintenance / Replacement	Findings (Sign. Inspector)
2.4	Limit stop of propeller pylon in fuselage	O Propeller pylon rests in retracted position on intended stop on engine compartment bulkhead. O All attached parts of the propeller pylon remain clear of the muffler in retracted position. O Check attachment, condition and function of limit switch, including its mounting.	Depending on condition	
2.5	Mechanics of engine bay doors	O Check for free movement of rods and low friction in system.	Depending on condition	
2.6	Hinges of engine bay doors (MM section 5.7)	O Check hinges for damages. O Check fit of engine bay doors in retracted position. O Check tight fit of deflector at right engine bay door. O Check side guides for retracted propeller in engine compartment O Check condition and loose length of rubber band that holds down engine bay doors: Rubber band has to be so short that, with retracted propeller pylon, it can only be lifted with noticeable tension over the tip of the propeller.	Depending on condition	
2.7	General	O Check clearance of cables and hoses during extension and retraction of propeller pylon. O Check clearance to airframe of propeller pylon and attached parts during extension and retraction of propeller pylon. O Check fire protection paint, heat insulation and fire protection foil in engine compartment for damages and signs of excessive heat.	Depending on condition	

CHECK LIST for Ser.-No..... Registration: ..... Date:……..

MAINTENANCE ACTION: O Annual inspection

O Inspection at engine operation time: ...../.....
Total time / since last inspection

O Other:…….

3. Fuel system

	INSPECTION ITEMS (LINK, REMARK)	INSPECTION MEASURE	Maintenance / Replacement	Findings (Sign. Inspector)
3.1.1	Fuel tank in fuselage (MM section 5.8)	O Check fuselage tank for external damages and leak tightness O Check hose mountings at fuselage tank for leak tightness. O Check electrical ground connection.	Depending on condition	
3.1.2	Wing fuel tank(s) (optional) (MM section 4.2.3 and 5.8)	O Check hoses and coupling at fuselage and wing for damages and leak tightness. O Check wing fuel tanks according to "Test instruction for flexible fuel tanks of type HFK-TLF" (see Appendix of MM). Test carried out according O method A) O method B) O Respect replacement interval.	Depending on condition. Replace wing fuel tank at least every 10 years.	
3.2.1	Fuel and vent lines in fuselage (MM section 4.2.3, FM Page 7.11.3)	O Check hoses for flexibility, any brittleness and leak tightness. O Check lines for leak tightness, sufficient fixation and any chafe marks. O Check functionality of drain valve O Check reservoir for visible leakage. O Respect replacement intervals.	See MM Section 4.2.3.	
3.2.2	Vent and overflow of fuselage tank (FM page 7.11.3) (Combine check with control of fuel level indication according to 4.2)	O Check that outlet opening of vent and overflow line from fuselage is clean O Fill the fuselage tank with installed refuelling pump until fuel is leaking into the reservoir. Check that fuel leaks only via the upper vent line into the reservoir. O With refuelling pump turned off, the reservoir has to empty automatically when fuel from fuselage tank is taken.	Depending on condition	

CHECK LIST for Ser.-No.....… Registration: ..... Date:……..

MAINTENANCE ACTION: O Annual inspection

O Inspection at engine operation time: ...../.....
Total time / since last inspection

O Other:…….

3. Fuel system (continued)

	INSPECTION ITEMS (LINK, REMARK)	INSPECTION MEASURE	Maintenance / Replacement	Findings (Sign. Inspector)
3.3	Fuel cock	O Check function. O Check tight attachment of limit switch at fuel cock.	Depending on condition	
3.4	Fuel filter in front of electrical fuel pumps (MM section 4.2.3, FM page 7.11.3)	O Check for visible leakages, damages to the housings and secure attachment. O Only use approved fuel filter O Respect replacement intervals.	Depending on condition. Replacement at least every 5 years or 25 hours engine operating time	
3.5	Electrical fuel pumps of regular and redundancy system	O Check function, attachment, condition and leak tightness of hoses and connections	Depending on condition	
3.6.1	Fuel filter in front of electrical refuelling pump (MM section 4.2.3, FM page 7.11.3)	O Only use approved fuel filter (No paper filter!). O Check fuel filter for visible contamination (Replacement is recommended if contamination is visible). O Respect replacement intervals	Depending on condition, Replacement at least every 5 years or 25 hours engine operating time	
3.6.2	Electrical refuelling pump	O Check function, attachment, condition and leak tightness of hoses and connections	Depending on condition	

CHECK LIST for Ser.-No.....… Registration: ..... Date:……...

MAINTENANCE ACTION: O Annual inspection

O Inspection at engine operation time: ...../.....
Total time / since last inspection

O Other:…….

4. Electrical system powerplant, engine test run

	INSPECTION ITEMS (LINK, REMARK)	INSPECTION MEASURE	Maintenance / Replacement	Findings (Sign. Inspector)
4.1	Cables and accessories	O Check all accessible cables, connectors, switches, screw connections and attachments for chafe marks and tight attachment	Depending on condition	
4.2	Powerplant control system (FM section 4.2.2 and 7.3, MM section 5.5)	O Check complete extension and retraction of powerplant with ignition switch, manual operation switch and emergency switch. O Check function of fire warning light (self-test, when powerplant operating system is switched on) O Check function of Fuel cock warning O Test of fuel level indication of fuselage tank: a) Set aircraft in calibration position for fuselage tank (s. FM section 4.2.2) and fill fuselage tank completely (fuselage tank is full as soon as fuel leaks into the reservoir) b) Fuel indication on operating unit hast to show 14 liters with completely filled fuselage tank. Otherwise recalibrate. c) If the recalibration is not successful, contact the manufacturer O Check function of propeller positioning system and automatic retraction system.	Depending on condition	

CHECK LIST for Ser.-No..... Registration: ..... Date:……..

MAINTENANCE ACTION: O Annual inspection

O Inspection at engine operation time: ...../.....
Total time / since last inspection

O Other:…….

4. Electrical system powerplant, engine test run (continued)

	INSPECTION ITEMS (LINK, REMARK)	INSPECTION MEASURE	Maintenance / Replacement	Findings (Sign. Inspector)
4.3	Engine test run (FM section 7.3 and 7.11)	O Generator charging control LED has to go out as soon as the engine is running. O Warm up the engine (app. 40°C cooling water temperature). **Outside temperature: _____ °C** **Atmospheric pressure: _____hPa** O Check stationary idle rpm with warm engine (app. 2200 - 2500 rpm, engine has to run smooth): **Cooling water temperature:___ °C** **Idle RPM:_____RPM** O Check stationary full throttle rpm with warm engine (min. app. 5600 - 5800 RPM): **Cooling water temperature:___ °C** **Full throttle RPM:_____ RPM** O Indicated max. cooling water temperature has to stay within the permissible range O Engine accelerates steadily, even at brisk acceleration O Ignition circuits check at 4000 RPM, max. drop 300 RPM. O Check of redundancy system: At 4000 RPM switch to redundancy system. Engine continues to run stable after a short drop in RPM. O Return to regular system works properly. O Check function of powerplant control: All operating indicators listed in FM page 7.3.18 and 7.3.19 display stable and plausible values. O No error messages by the operating unit at engine test run. O Check function of ignition switch	Depending on condition	

Arcus M

Inspection instructions for flexible wing fuel tanks model HFK-TLF

The flexible wing fuel tanks model HFK-TLF are built from a two-layer design:

- The internal bag contains the fuel.
- The external cover protects the fuel bag from electrostatic charge. For this reason the external cover needs not to be impermeable to liquid.

The wing fuel tanks must be checked regularly for tightness. These inspections partly can be accomplished with the fuel tank installed in the wing. The selected inspection method affects the inspection intervals to be applied:

Selected inspection method	Inspection interval applicable for the **internal bag**	Service life
A) Inspection basically with the fuel tank installed in the wing	• Annual: Inspection according to inspection instruction 1). • Latest 5 years after installation / the latest inspection of the wing fuel tank according to inspection instruction 2) this inspection must be repeated. *)	see MM section 4.2.3
B) Inspection only with the fuel tank removed from the wing	• Latest 2 years after installation / the latest inspection of the wing fuel tank according to inspection instruction 2) the inspection must be repeated. *)	

*) The first time limit to be fulfilled is mandatory

The inspection instructions mentioned in the table above are listed on the following pages.

For the fuel lines and ventilation lines attached to the wing fuel tank and connected to the fuselage fuel system the inspection intervals and service life from MM section 4.2.3 are applicable.

Arcus M

Inspection instructions for flexible wing fuel tanks model HFK-TLF
(continued)

Inspection instruction 1): Inspection of the **wing fuel tank installed** in the wing (see picture 1)

1. Drain all fuel from the wing fuel tank.

2. Inspection of the pressure relief valve:
   - Connect counter piece of the fuel line plug-in-coupling with manometer and rubber bellow (see picture 1).
   - Slowly fill the fuel tank with air.
   - When the test load in the internal bag has reached **0,1 bar** ± 0,02 (1.450 psi ± 0.290) the pressure relief valve must open (pressure can not be raised further, there is a remarkable airflow through the ventilation line).
     If the test load is reduced the pressure relief valve must close again at a pressure within the given limits.

3. Pressure test of the internal bag:
   - Close ventilation line with counter piece.
   - Connect counter piece of the fuel line plug-in-coupling with manometer and rubber bellow.
   - Slowly fill the fuel tank with air to a pressure of **0,25 bar** (3.626 psi).
   - The internal bag of the wing fuel tank is supposed to be tight if the pressure does not drop within a period of 30min.

Note:
When the inspection of the internal bag has been successfully completed it is recommended to remove the remaining air to a large extend from the internal bag. Removing the air significantly facilitates further refueling and draining of the wing fuel tank in operation.
This can be accomplished for example by carefully refueling the wing fuel tank to its maximum and then drop all fuel again.

Inspection instructions for flexible wing fuel tanks model HFK-TLF
(continued)

Inspection instruction 2): Inspection of the **wing fuel tank removed** from the wing

1. Drain all fuel from the wing fuel tank and remove it from the wing (see MM section 5.8).

2. Inspection of the relief pressure valve: see inspection instruction 1).

3. Pressure test of the internal bag:
   - Close ventilation line with counter piece.
   - Connect counter piece of the fuel line plug-in-coupling with manometer and rubber bellow.
   - Slowly fill the fuel tank with air to a pressure of **0,40 bar** (5.801 psi).
   - The internal bag of the wing fuel tank is supposed to be tight if the pressure does not drop within a period of 5min.

4. When the inspection of the internal bag has been successfully completed or the after the fuel tank has been repaired reinstall the wing fuel tank in the wing (see MM section 5.8).

5. After the wing fuel tank has been reinstalled in the wing repeat pressure test according to inspection instruction 1) to check the tightness of the recently installed hose connections.

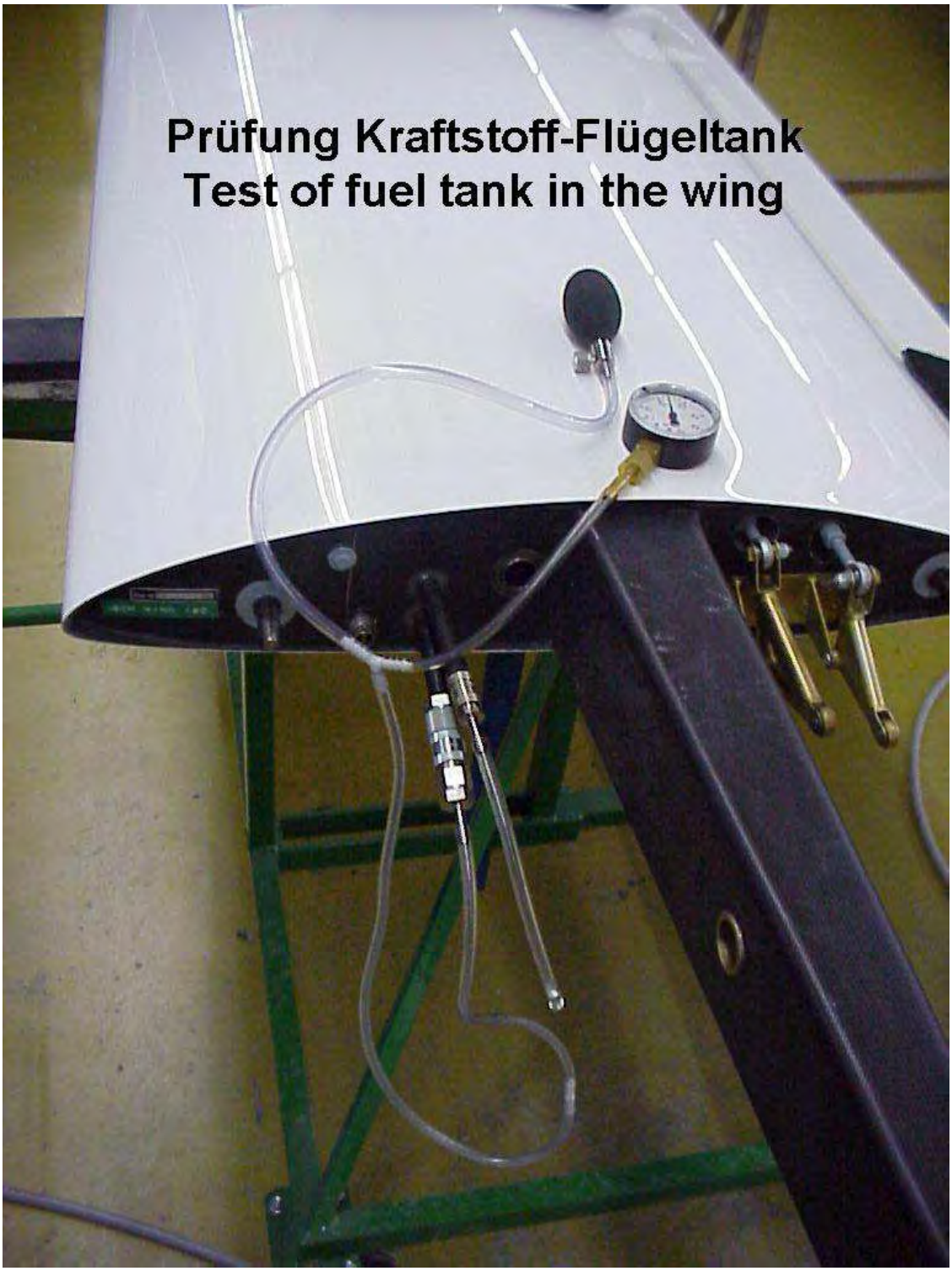
Warning:

The required pressure test load required in inspection instruction 2) may be applied only with the wing fuel tank removed from the wing! Otherwise there is the risk to damage the wing structure!

In case of reasonable suspicion for leakage of a wing fuel tank the fuel line of the defect wing fuel tank may not be connected to the fuselage fuel system any more. Otherwise there might be uncontrolled fuel flow to the wing fuel tank and loss of fuel from the fuselage fuel tank.

Arcus M

Inspection instructions for flexible wing fuel tanks model HFK-TLF
(continued)



Picture 1: Pressure test of a wing fuel tank installed in the wing (Ventus)

Repair Instructions for Arcus M

The components of this aircraft are constructed as follows:

1. Wings
   Inner wing

   CFRP-foam-sandwich, with HEREX C 70.55,
   thickness 8 mm (0.31 in.) resp. 6 mm (0.24 in.)

   Wing tip extension

   CFRP-foam-sandwich,
   with HEREX C 70.55, thickness 6 mm (0.24 in.)

   with winglets

   Pure CFRP-shell

2. Wing flaps:

Both inner wing flaps:	CFRP-foam-sandwich, with HEREX C 70.55, thickness 4 mm (0.16 in.)
Both outer wing flaps:	GFRP/CFRP-shell

3. Fuselage

Forward section:	Pure CFRP/Kevlar/GFRP-shell
Aft section:	Pure CFRP-shell

4. Fin

   GFRP/foam-sandwich
   with HEREX C 70.55, thickness 4 mm (0.24 in.)

5. Rudder

   GFRP/foam-sandwich
   with HEREX C 70.55, thickness 4 mm (0.24 in.)

6. Horizontal stabilizer

   GFRP/foam-sandwich
   with HEREX C 70.55, thickness 6 mm (0.24 in.)

7. Elevator

   Pure CFRP/Kevlar/GFRP-shell

The first stage in carrying out repairs on components constructed from fiber reinforced plastic (FRP) is to examine the construction of the component at the location in question and to proceed in accordance with the latest applicable issue of the

„REPAIR INSTRUCTIONS FOR SCHEMPP-HIRTH SAILPLANES AND POWERED SAILPLANES CONSTRUCTED FROM FIBER REINFORCED PLASTIC“

General Notes:

For repairs only the following resin systems may be used:
werden:

1. For AFK/CFK/GFK-components

Resin	Hardener	Mixing proportion (by weight)	Curing
Momentive Speciality Chemicals			
L 285	H 285 H 286 H 287	100 : 38	15 h at 55°C (122°F)
L 335	H 335 H 340		
Sika			
Biresin CR 122	Biresin CH 122-3 CH 122-5 CH 122-9	100 : 40	according to product datasheet for achieving LBA-RHV minimum requirements

Information on the latest applicable product data sheets are to be observed.

2. For engine compartment of SOLO 2625-02i

Resin	Hardener	Mixing proportion (by weight)	Curing
Momentive Speciality Chemicals			
L 20	Laromine C260 SL	100 : 34	15 h at 90°C

Information on the latest applicable product data sheets are to be observed.

Materials (and suppliers) for the repair of CFRP-components

Resin system: See page 2

Glass fibre cloth:
47 g/m² bzw. 105 g/m²

(e.g.Quality 02037 resp. 91111 from P-D Interglas Technologies)

Carbon fiber cloth:
(Yarn DIN 65184 CC 200 f 3000-F)

Cloth 1/1 (warp equal weft)

a) Weight 200 g/m²:
quality e.g.:
Sigratex KDL 8003 from SGL Carbon Group, Meitingen
Style 450 from C. Cramer & Co., Heek-Nienborg

b) Weight 285 g/m²:
quality e.g.:
Style 475T from C. Cramer & Co., Heek-Nienborg

c) Weight 240 g/m² 245 g/m² or 250 g/m²:
quality e.g.:
Style 262 resp. 460 from ECC
KDU 8049/8043 from SGL Carbon Group, Meitingen

d) Weight 200 g/m²: M40J of Yarn DIN 65184
– fiber class L through P
quality e.g.:
KDK 8040/T from SGL Carbon Group, Meitingen
Style 887 from C. Cramer & Co., Heek-Nienborg

Unidirectional carbon fiber cloth:

Weight 140 g/m²
(carbon fiber 120 g/m², glass fiber 20 g/m²),
quality e.g.:
Style 763 from C. Cramer & Co., Heek-Nienborg
MDL 9001 from SGL Carbon Group, Meitingen

Carbon fiber tape:
(Yarn DIN 65184)
quality e.g.:
Sigratex KDU/NF6, 39-7.5 (Sigratex KDU 1024)
SGL Carbon Group, Meitingen

Carbon fiber / Aramidfiber (Kevlar) cloth:
(CF: Yarn DIN 65184 CC 200 f 3000-F,
AF: Yarn DIN 65427)

Linen cloth 1/1 (warp equal weft)

Weight 205 g/m²
quality e.g.:
98355, P-D INTERGLAS TECHNOLOGIES

Carbon fiber rovings:
(Yarn DIN 65184 CC 800 f 12000-F)

Tenax HTA 5131 800tex f 12000to, Tenax-Fibers, Wuppertal

Surface coating (from MOMENTIVE, Esslingen):

UP-Vorgelat, white,	T 35
UP-Hardener	SF 10
UP-Thinner	SF

Mixing proportion by weight:

100 parts UP-Vorgelat	T 35
to	
10 parts hardener	SF 10

2K-Acryl-Mix-coat system MIPA (from MIPA AG, Essensbach):

MIPA 2K-Acryl-Mix-coat
MIPA 2K-HS-Hardener
MIPA 2K-Thinner

Mixing proportion by weight:

100 parts coat to
50 parts hardener

Other comparable coating systems can be used, provided they do not attack the fibre-composite structure. Follow the respective manufacturer's instructions!

Repair Instructions for Sailplanes and Powered Sailplanes constructed from Fiber Reinforced Plastic (FRP), manufactured by Schempp-Hirth, Flugzeugbau GmbH, Kirchheim/Teck

1. Table of contents
2. General
3. Materials
4. Kinds of construction
5. Repair procedures for components constructed from Fiber Reinforced Plastic (FRP)
6. Repairing metal fittings
7. Working with gel coat
8. Lengths of scarf joints (spliced) for various fabrics

Record of revision

Rev. No.	Date of issue	Page affected	Date inserted
1	December 1999	5.3.1	

2. General

Prior to a repair it must be clarified, where and by whom the repair is to be conducted.

All materials used for a repair must either be specified in these Repair Instructions, or in the Maintenance Manual of the aircraft affected, or be stated directly by the manufacturer.

a) Repairing components constructed from Fiber Reinforced Plastic (FRP)

Should a fracture or damage have occurred to the sailplane/powered sailplane, first the area affected must be thoroughly inspected to determine exactly the extent of damage and the structure. The number of cloth layers and the type of cloth can usually be determined by sanding the broken laminate. If this is not possible, remove a piece of the fractured laminate and ignite it. After the resin is burnt, the type of cloth, the number of layers and the direction of the weave will be evident (only applicable for glass fiber and carbon fiber reinforced structures).

If there is any doubt as to the lay-up of a laminated structure, contact the manufacturer of the aircraft or the company in charge of its service.

b) Repair work on metal fittings

If - for unknown reasons - damage has occurred to any of the metal fittings on the aircraft, the manufacturer or the company in charge of its service must be contacted in every case.

Repairs involving welding may only be accomplished by persons authorized for aircraft welding.

For all steel parts the "Tungsten inert gas arc welding technique" is employed by the manufacturer.
For all steel combinations - except non-corroding steel - welding electrodes of quality No. 1.7734.2 may be used.

3. Materials

a) Components constructed from fiber reinforced plastic (FRP)

Sailplanes and powered sailplanes manufactured by Schempp-Hirth are constructed from the following materials:

- Glass fiber reinforced plastic (GFRP)
- Carbon fiber reinforced plastic (CFRP)
- Aramid fiber reinforced plastic (AFRP) (SFRP)

The Aramid fiber (a synthetic fiber, also called "Kevlar", DuPont's trade name for this fiber) is usually woven in combination with carbon fiber.

For a specification of the materials used for the construction of the individual aircraft refer to its Maintenance Manual.

For repairs only these specified materials must be used or those substitute materials shown on page 3.2.

b) Components constructed from metal

Various materials and qualities are used for the metal parts - for repairs of such parts the manufacturer should therefore always be contacted.

TABLE OF FIBER MATERIALS

Fiber material	Cloth designation accord. to LN-Specif.	Interglas code or manufacturer's designation	Manufacturer	Weight (g) per m^2	Remarks
Glass	8.4545	91 110 *	Interglas	108	Cross twill
Glass	8.4548	92 110 *	"	163	Twill weave
Glass	8.4551	92 125 *	"	285	" "
Glass	8.4554	92 140 *	"	395	" "
Glass	8.4520	92 145 *	"	220	Warp direct.
Glass rovings EC9-756 K 43	8.4674 LN 9103	-	Gevetex Düsseldorf	-	-
Carbon		98 140 *	Interglas	200	Plain weave
Carbon		98 160 *	"	285	" "
Carbon		CX 14 T	Aerotex Willich	140	Unidirect. fabric (tape)
Carbon		98 340 *	Interglas	170	Warp direct.
Carbon		Sigratex KDL 1024 75 mm wide	Sigri, Meitingen		Warp direct.
Carbon fiber rovings	LN 29964 KC 20 FYS	e.g. Tenax HTA 7 12000	Enka, Wuppertal	-	-
Aramid/Carbon		98 355 *	Interglas	Aramid 78 Carbon 122	Cross twill
Aramid		98 608 *	"	110	" "
Aramid		98 611 *	"	170	Plain weave
Aramid		98 616 *	"	158	Warp direct.

* By Interglas AG, 7900 Ulm - for glass fibers Finish I 550

Resin systems : For the permissible resin systems refer to the Maintenance Manual of the individual aircraft

Surface coating : For information on the gel-coat to be used refer to the Maintenance Manual of the individual aircraft

Resin filler materials

Micro balloons : Union Carbide/Brenntag GmbH
Aerosil : Degussa - Wolfgang
Styrofoam kernels : BASF
Cotton flocks : Schwarzwälder Textilwerke

Rigid foam : Divinycell H 60 by Messrs. Diab Baracuda (equivalent to Conticell C 60)

For the repair of areas not too extensively damaged, the following resin systems (curing faster) are recommended:

For GFRP components:

Resin GE 162 with hardener LAROMIN C 260 (Epikure 113)

or

Resin SCHEUFLER L 285 with hardener 286

For CFRP or CFRP/Kevlar components:

Resin SCHEUFLER L 285 with hardener 286

For components showing extensive damage it is more favourable to use a resin system offering a longer pot life:

For GFRP, CFRP or CFRP/Kevlar components:

Resin GE 163 with hardener LAROMIN C 260 (Epikure 113)

or

Resin SCHEUFLER L 285 with hardener 287

For all resin systems the prescribed curing period and temperature must be observed.

For the preservation of the surface finish of the component concerned, only the area of repair and not the entire component should be heat-treated.

4. Kinds of construction

Although the laminated skin of sailplanes and powered sailplanes is a "stressed skin structure", bearing very high loads in some areas, it is for weight-saving reasons on principle very thin.

Depending on size and shape of the individual component, it is either constructed as a pure GFRP, CFRP or CFRP/Kevlar shell (thickness 1 to 3 mm / 0.04 to 0.12 in.), or as a so-called "sandwich" with an outer skin (thickness approx. 1 mm / 0.04 in.), a foam core (thickness 4 to 8 mm / 0.16 to 0.31 in.) and an inner skin (thickness approx. 1 mm / 0.04 in.).

On components constructed from fiber reinforced plastic (FRP), the orientation of the fibers is the absolutely deciding factor for its strength and stiffness.

It is therefore most important that - in any direction of a component to be repaired - at least the same weight-to-area ratio is achieved that it originally had. Special attention must also be paid as to the thickness of the foam core on components constructed as a sandwich.

For the spar flanges of a wing, so-called "rovings" are used, which are the highest stressed structures in flight.

For the repair of components having rovings embedded, the manufacturer must therefore always be contacted.

The kind of construction of the major components is given in the Maintenance Manual of the aircraft concerned.

All components made from fiber reinforced plastic have been heat-treated by the manufacturer during construction of the aircraft. By post-curing the aircraft components, all the chemical reactions causing the resin to cure, have finished, so that even on hot and sunny days the aircraft has sufficient strength.

Repaired areas must therefore also be post-cured - see Maintenance Manual, chapter "permissible resin systems".

5. Repair procedures for components constructed from reinforced plastic (FRP)

In order to avoid tension peaks, there must be no abrupt differences in the thickness of the laminate. Also oval or round cut-outs should be made instead of angular openings and the transition from the damaged/repaired area to the sound structure should be made gradually. Added or inserted cloth layers should therefore always be graduated or scarfed out.

As the transfer of the shear load into the lower cloth layers must take place via the length of the overlap or scarf with the bonding force of the resin, the overlap/scarf length depends on the type of cloth, its weight and the orientation of the fibers.

For GFRP the scarf slope is 50 : 1, for CFRP and Aramid fibers the scarf slope is 100 : 1.

Warp-directional cloth or multi-axial knit fabrics (tape) only need to be scarfed in the direction of the fibers.

A table showing the required scarf or overlap lengths is provided in section 8.

On principle it is to say that the repair procedure for GFRP and CFRP is the same, except for the scarf slope and the material used originally.

Repairs on Aramid (Kevlar) components or on parts made from Aramid (Kevlar)/Carbon fibers are more difficult because of the "unpleasant" characteristics of the Kevlar fibers with regard to cutting and sanding them.

For minor repairs it is therefore practicable to substitute the Aramid cloth or Aramid/Carbon cloth by using pure carbon cloth.

For larger repair areas on components having Aramid fibers, the manufacturer should be contacted for his advice.

Cloth of equal material may also be substituted such that the weight-to-area ratio in the direction of the fibers is at least achieved.

Example (1) 1 layer of cloth No. 92125 may be substituted by
2 layers of cloth No. 92110

Example (2) 1 layer of cloth No. 92145 may be substituted by
1 layer of cloth No. 92140 (as both have the same weight-to-area ratio in warp direction)

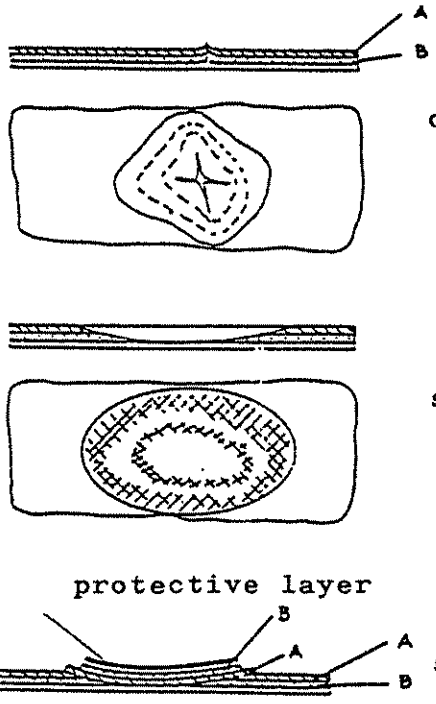
The foam used for sandwich constructions does not require scarfing - a butt joint (bonded with resin) is sufficient.

Laminating principles for repairs

In the area of repair, the new cloth layers are always laid up in reverse sequence onto the scarfed out sound original laminate, thus ensuring that the cloth layers taken out are substituted by layers of the same size.

Note: From experience gained it is recommended to use a fine cloth for the uppermost layer, thus achieving a long-lasting good surface quality.

For repairs the final layer should therefore always be a fine cloth - e.g. No. 92110, or one being identical with the component's original uppermost layer - laid up in addition to the scarfed-in layers. This also serves the purpose that - on sanding the area of repair - first this layer and not the lower stressed layers will get damaged.



Resin and/or the gel coat will only adhere to a roughened surface. Therefore all areas to be bonded, laminated or painted require sanding! Use a coarse dry sand paper (80 to 150 grit) prior to laminating. For repainting sand the old gel coat using a wet (or dry) sand paper with 240 to 320 grit. If the top layer of a laminate was covered with Nylon cloth, roughening is not required, provided the surface is clean and free from grease.

5.1 Repairing a pure glass fiber shell

Repair example of a component laid up from

1 x 92 110 ※ (A) outside
1 x 92 125 # (B)
1 x 92 140 ※ (C) inside

1. Determine the type of cloth, the number of layers and the orientation of the weave.

2. Determine the length of the scarf joint in compliance with section 8.

   92 110 : 5 mm (0.20 in.)
   92 125 : 10 mm (0.39 in.)
   92 140 : 15 mm (0.59 in.)

   Total length of scarf joint therefore is 30 mm (1.18 in.).

   Experience in repairs has shown that by assuming 15 mm (0.59 in.) for each layer, a determination of the total length of a scarf joint is also possible.

3. Remove damaged laminate using a sanding block (80 to 150 grit) or an angle grinder and scarf the sound laminate to the width required for the scarf joint.

4. For holes with a diameter of more than 50 mm (1.97 in.), a support must be attached to the inside, thus preventing a sag of the laid-up cloth layers.
   The support can be made from thin plywood (to be sealed with resin) or from a thin laminate, bonded to the inside with the aid of an adhesive compound.

   If the repair area is not accessible from the inside, trim the opening in the shell to an oblong shape, thus permitting the backing plate to be inserted from the outside and rotated to cover the hole. It is then glued in position with the aid of a cord loop or nail (driven through the plate), by which it is drawn against the inner skin.

5. Clean area to be re-laminated (if necessary, sand again and remove the dust with a vacuum cleaner).

6. Cut glass cloth layers to the required size and lay them up as follows (for the assumed laminate):

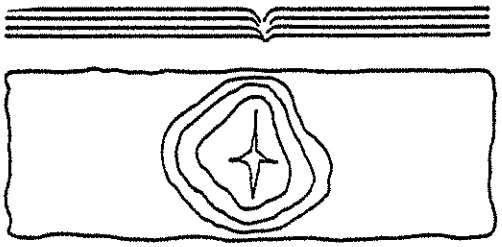
   (A) 1 x 92 110 ※ (the largest layer)
   (B) 1 x 92 125 #
   (C) 1 x 92 140 ※ (the smallest layer)
   (D) 1 x 92 110 (the protective layer, size same as C)

7. After curing trim off the protruding edges and sand the entire repair area to level the overlaps, which must then show about the scarf length previously determined. Above the former area of damage the layers A) through C) must not be harmed as otherwise the thickness of the laminate would be insufficient.

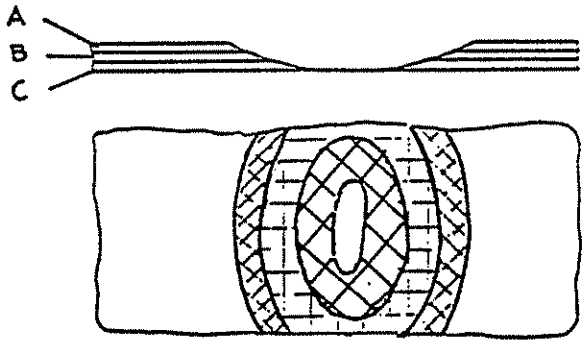
Repairing a pure shell (ctd.)

For re-coating the damaged area refer to section 7.

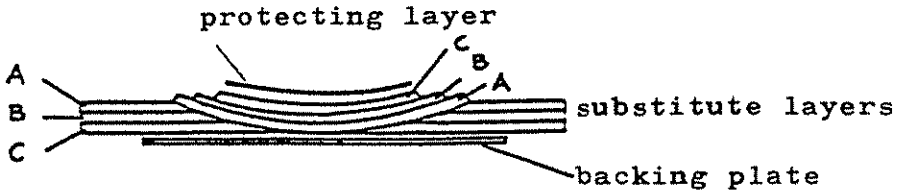
Damages not reaching down to the innermost layer are repaired in the same manner and only those layers are substituted (by making scarf joints) that have been harmed.



damaged aera



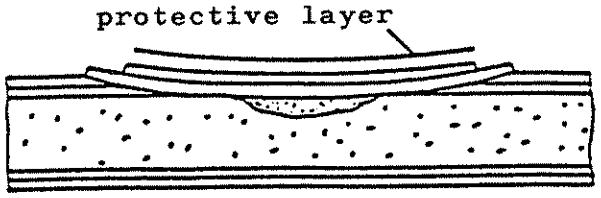
scarf joint



5.2 Repairing a sandwich shell

A) Only outer laminate destructed

1. Determine the type of cloth, the number of layers and the orientation of the weave.
2. Determine the length of the scarf joint in compliance with section 8.
3. Remove damaged laminate, scarf sound laminate to width required for scarf joint. Remove destructed foam - be cautious not to harm the inner laminate.
4. Cut substitute cloth layers to required size and shape (sequence of lay-up in reverse of sound layers) and do not forget the additional protective layer (size to match smallest layer).
5. Fill up the area where the foam was removed with a microballoon/resin mixture (small pieces of foam may be added) and make sure that the surface is level and free from waves so that the glass laminate to be laid up does not protrude above the contour.
   If the area of repair is small, apply substitute cloth layers "wet in wet", otherwise let mixture cure, sand to proper contour and
6. Lay-up substitute cloth layers in the correct sequence - see "repairing a pure shell".
7. Sand repaired area after curing. If necessary, apply filler and sand again. Note that directly above the former area of damage only the protective layer may get harmed.
8. Apply gel-coat - see section 7.



Note: If under pressure of time, the curing of the repaired area may be accelerated by using a heater - but only once the resin has set, otherwise air in the core may expand and form air voids.

5.2 Repairing a sandwich shell

B) Sandwich totally destructed (see sketch on page 5.2.3)

1. Determine type of cloth, number of layers and weave orientation of inner and outer laminate.

2. Determine length of scarf joint/overlap for inner and outer laminate in compliance with section 8.

   The substitute cloth layers for the inner skin are always overlapped (and not scarfed in) as the thin laminate might break when trying to scarf it.

3. Remove damaged outer laminate from where it is not firmly attached to the foam core and remove the foam until its proper bonding to the inner laminate is evident. Then remove more foam as required for overlapping the substitute cloth layers.

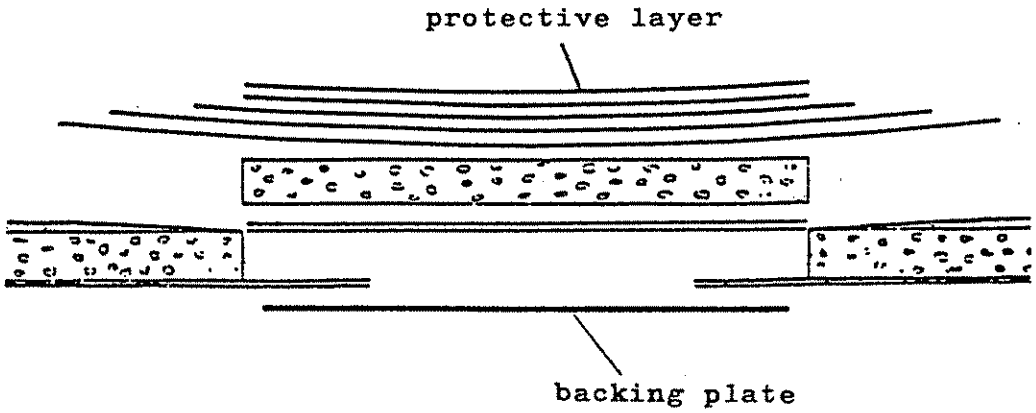
   In order to avoid that the protruding edge of the inner laminate breaks off, attach from the inside a support made from thin plywood (to be sealed with resin) or from a thin laminate using an adhesive compound.

4. Lay-up substitute layers onto inner skin. Cutting the cloth to exactly the size needed is recommended, as it is beneficial to continue working "wet in wet" by filling up the hollow space with a mixture of resin, microballoons and styrofoam kernels - provided the repair area does not exceed about the size of a fist. For larger areas a new foam layer must be used (inner skin already applied and cured) and glued in position using a resin/micro balloon mixture. This pre-fabricated layer may be pre-shaped with the aid of a hair dryer, but must in any case be pressed down to the proper contour by means of weights.
   After curing sand the foam sandwich layer to be slightly "undersized" so that later the outer laminate does not protrude above the contour.

Sandwich totally destructed (ctd.)

5. Lay-up outer cloth layers as described in chapter A).
   For their better bonding, coat the foam with a resin/microballoon mixture and apply layers "wet in wet".

6. For the remaining steps of the repair continue as described in chapter A).



5.3 Splicing rovings and multi-axial knit fabrics

In the fuselage and also in other components there are reinforcements made from rovings or from multi-axial knit fabrics (ribbons/tapes).

As it is most difficult to determine the exact number of such rovings or tapes while clearing the damaged area, the manufacturer of the aircraft or the company in charge for its service must always be contacted for instructions concerning the repair of components having rovings/tapes as reinforcement.

Exception: The frame of the canopy - no consultation required for this component.

NOTE : For the repair of components constructed from rovings, the resin system type L 335 / hardener type 335 through 340 is n o t permissible!

6. Repair work on metal fittings

If - for unknown reasons - damage has occurred to any of the metal fittings on the aircraft, the manufacturer or the company in charge of its service must be contacted in every case.

Repairs involving welding may only be accomplished by persons authorized for aircraft welding.

For all steel parts the "Tungsten inert gas arc welding technique" is employed by the manufacturer.
For all steel combinations - except non-corroding steel - welding electrodes of quality No. 1.7734.2 may be used.

7. Re-coating (painting) damaged areas

Usually the process of re-coating a repaired area is more difficult and labourous than firstly expected.

The following is to be observed:

- Prior to applying the gel-coat, the repair area must be perfectly re-profiled - use a polyester filler for this (as used for cars).

- Hand-sand the existing gel-coat surrounding the repaired area with a 240 to 320 grit wet sand paper so that the new gel-coat will properly adhere and be flush with the original coating after sanding.

  The area to be sanded for re-coating must therefore always be larger than the area of the repair.

- Clean the repaired area carefully - to be free from any dust - and apply the gel-coat either with a brush (for smaller patches) or with a spray gun (approx. 500 g needed per square meter). The transition from the existing to the new coating must show no steps, thus facilitating the subsequent finishing process.

- Sand re-coated area (after gel-coat has fully hardened) first with a 240 to 400 grit wet sand paper, then sand again with a 500 to 800 grit paper.

  Should imperfections require another coating, always first roughen the surface using a 320 grit paper (or coarser).

- Finally polish the sanded "finished" area with the aid of a polish compound or hard wax applied with a buffing wheel.

WARNING: For repairs on control surfaces always observe their weight limits and hinge moments - see Maintenance Manual of the aircraft affected !

8. Lengths of scarf joints (splices) for various fabrics

Glass fiber cloth (per layer)

Cloth designation	Weight (g) per m^2 (without resin)	Thickness (mm) (with resin)	Length (mm) of scarf joint *
91 110	108	0.12	5
92 110	163	0.18	5
92 125	276	0.30	10
92 140	390	0.43	15
92 145	220	0.24	15 (longit.)

Carbon fiber and Aramid fiber cloth (per layer)

Cloth designation	Weight (g) per m^2 (without resin)	Thickness (mm) (with resin)	Length (mm) of scarf joint *
98 140 (CF 200)	200	0.30	15
98 160 (CF 285)	285	0.43	25
98 340 (warp direct.)	170	0.25	15 (longit.)
SIGRATEX Tape (KDU 1024)	210	0.25 - 0-32	30 (longit.)
CX 14 T (multi-axial knit fabrics)	140	0.21	25 (longit.)
Aramid/ Carbon 98355	200	0.35	15

Scarfing sandwich core materials (e.g. Divinycell or honey comb) is not required.

* Scarf joints (splices) with a length of less than 5 mm (0.20 in.) make no sense!

Conversion: 1 mm = 0.03937 in.